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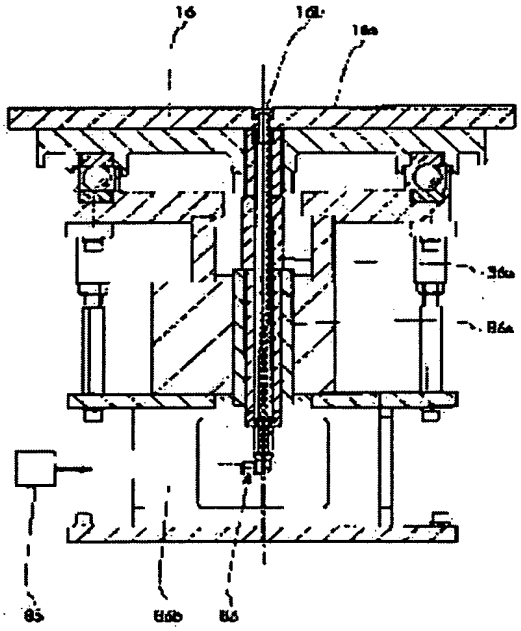
(54) DOUBLE-SIDE POLISHING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To supply a liquid abrasive of a sufficient flow rate to the polishing part by forcibly sending the liquid abrasive from an abrasive supply hole arranged in an upper surface plate and/or a lower surface plate.
SOLUTION: An abrasive supply hole 16b is arranged in a lower surface plate 16. A forcibly sending supply device 85 for forcibly sending slurry is composed of a slurry storage tank and a slurry sending pump. A communicating passage 86 is composed of a vertical pipe 86a communicating with the hole 16b by passing through into a hollow autorotating shaft 36a, a horizontal pipe 86b communicating the vertical pipe 86a with the sending supply device 85 and a pipe joint. The slurry pressurized to high pressure is sent through this communicating passage 86 to be delivered from the abrasive supply hole 16b. Since the slurry delivered from the abrasive supply hole 16b flows to the outer periphery from the central part by centrifugal force by being received to the polishing surface of the lower surface plate 16 by this abrasive supply means, the slurry can be sufficiently supplied to the whole polishing part.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The top board and lower lapping plate which have the polished surface which moves relatively and grinds it to this work piece while inserting the tabular work piece arranged in the bore of the carrier with which a bore prepares and grows into a thin plate, and this carrier from the upper and lower sides, The carrier circular movement device in which carry out the circular motion which does not rotate said carrier in a field parallel to the field of this carrier, and turning migration of said work piece held between the top board and the lower lapping plate within said bore is carried out, Double-sided polish equipment characterized by having an abrasive material supply means to make said fed liquefied abrasive material discharge from the hole for abrasive material supply prepared in the top board and/or the lower lapping plate that a liquefied abrasive material should be supplied to the polish section which said polished surface and work piece contact and grinds this work piece.
[Claim 2] Double-sided polish equipment according to claim 1 characterized by being in said abrasive material supply means, having prepared two or more holes for said abrasive material supply in a location which is different about the direction of a path of a top board and/or a lower lapping plate, and establishing two or more paths which supply said liquefied abrasive material corresponding to the hole for these two or more abrasive material supplies.
[Claim 3] Said top board and lower lapping plate are double-sided polish equipment according to claim 1 or 2 characterized by carrying out rotation actuation a core [an axial center parallel to the direction which intersects perpendicularly with the field of said carrier].
[Claim 4] The carrier electrode holder with which said carrier circular movement device holds said carrier, The shaft by the side of the electrode holder which an axial center is parallel to the direction which intersects perpendicularly with the field of said carrier, and is fixed to revolve by said carrier electrode holder, And it has a shaft by the side of the base which keeps a predetermined distance and is fixed to revolve by the base while an axial center is parallel to the shaft by the side of this electrode holder. The crank member to which the circular motion which does not rotate a carrier electrode holder to a base by making it circle in the shaft by the side of an electrode holder centering on the shaft by the side of said base is carried out, Double-sided polish equipment according to claim 1, 2, or 3 characterized by providing the driving gear made to rotate this crank member centering on the shaft by the side of a base.
[Claim 5] It is double-sided polish equipment according to claim 4 characterized by coordinating the shafts by the side of said base by synchronous means, such as a timing chain, so that two or more said crank members are prepared, and these two or more crank members may synchronize and it may move circularly.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to double-sided polish equipment. By rotating EKUSUTANARUGIYA (henceforth a "external gear"), and an internal gear (henceforth a "internal gear") with a different angular velocity from the former as double-sided polish equipment While making the carrier equivalent to the epicyclic gear which supported the processing ingredient (henceforth a "work piece") rotate, it is made to revolve around the sun. There is a thing using the epicyclic gear device which they move relatively and grind to a work piece while the top board and lower lapping plate of the carrier which have the polished surface allotted up and down sandwich a work piece from the upper and lower sides. It is used as wrapping equipment (lapping machine) or polishing equipment, this double-sided polish equipment has a high precision, and since it can grind both sides simultaneously, floor to floor time is short, and ends, and it fits split polish processing of the silicon wafer used as the raw material of a semiconductor chip etc.
[0002]
[Description of the Prior Art] The configuration of the polishing equipment using the conventional epicyclic gear device is explained based on drawing 11 . 112 is a top board, 114 is a lower lapping plate, abrasive cloth (cross) is attached to each front face, and the polished surface is formed by the abrasive cloth. 116 is an external gear and 118 is an internal gear. Moreover, it is a carrier, and a work piece 121 is held in the bore drilled by this carrier 120, and 120 gears with an external gear 116 and an internal gear 118, and rotates. A top board 112 is coordinated with top board lathe dog 112a, and gear 112c is prepared at the head of shaft 112b which hung from this top board lathe dog 112a. Gear 112c gears to idle-gear 112d, and it has geared to gear 112e the idle-gear 112d. This gear 112e is prepared in a spindle 126 and the same axle that it should rotate to a spindle 126 and one. The lower lapping plate 114 is coordinated with gear 114b prepared in the lower lapping plate 114 on the same axle at the spindle 126 through gear 114a prepared in the same axle. The external gear 116 is coordinated with transfer gear 116b prepared in the external gear 116 on the same axle at the spindle 126 through gear 116a prepared in the same axle. The internal gear 118 is coordinated with transfer gear 118b prepared in the internal gear 118 on the same axle at the spindle 126 through gear 118a prepared in the same axle. That is, this polishing equipment serves as 4 so-called way actuation methods which carry out revolution actuation of an external gear 116, an internal gear 118, a top board, and the lower lapping plates 112 and 114 with one driving gear. In addition, a spindle 126 is connected with the adjustable reducer 132, and the adjustable reducer 132 is connected with the motor 134 through the belt 136, and it controls the rotational speed of a spindle 126.
[0003] According to the polishing equipment using this epicyclic gear device, for example so that the direction of the angular velocity of an internal gear 118 may become large compared with the angular velocity of an external gear 116 The speed ratio of gear 116a and transfer gear 116b, And when the speed ratio of gear 118a and transfer gear 118b is set up, respectively, the carrier 120 which got into gear between the external gear 116 and the internal gear 118 revolves around the sun in the same direction (for example, it considers as a "counterclockwise rotation") as the hand of cut of an internal gear 118, and rotates clockwise. Moreover, although a lower lapping plate 114 similarly rotates counterclockwise, since idle-gear 112d intervenes, a top board 112 rotates clockwise. In addition, according to polish conditions, a hand of cut, rotational speed, etc. of a carrier

120 can be changed by setting out of the angular velocity of an external gear 116 and an internal gear 118.

[0004] Moreover, the liquefied abrasive material containing an abrasive grain etc. is supplied to the polished surface of the front flesh side of a work piece 121, and polish of a work piece 121 is suitably made according to an operation of the liquefied abrasive material. In polish of a silicon wafer, the abrasive material (common name "a slurry") by which alkaline polish liquid comes to distribute an abrasive grain is usually supplied between a silicon wafer and the polished surface of the surface plate for polish, and polish is made. Generally making a top board 112 trickle a liquefied abrasive material in the vertical direction from the upper part as an approach of supplying a liquefied abrasive material through the hole for abrasive material supply prepared by penetrating using pump power and gravity, and supplying is made. The liquefied abrasive material breathed out from the hole for abrasive material supply passes through between ****** carrier 120 comrades, flows to up to the polished surface of a lower lapping plate 114, and is supplied to the polish section which the polished surface and work piece 121 of a lower lapping plate 114 contact, and grinds the work piece 121 while it is supplied to the polish section which the polished surface and work piece 121 of a top board 112 contact, and grinds the work piece 121.

[0005] Drawing 12 is a top view explaining the example of arrangement of the carrier 120 concerning the polishing equipment of drawing 11 , and the opening section A is between ****** carrier 120 comrades. This opening section A exists by sufficient size for the bore section and the outer-diameter section, and a liquefied abrasive material is suitably supplied also to up to the polished surface of a lower lapping plate 114. Thus, a liquefied abrasive material is fully supplied about both sides of a work piece 121 by the supply means from the easy upper part. Since according to this polishing equipment a liquefied abrasive material can be supplied suitably and a carrier 120 can be made to exercise intricately, polish unevenness is prevented and work-piece 121 (for example, silicon wafer) polish can be carried out at homogeneity. Therefore, the display flatness of a work piece can be improved. Moreover, since both sides of a work piece 121 can be ground simultaneously, polish effectiveness can be improved.

[0006] However, with the double-sided polish equipment using the above-mentioned conventional epicyclic gear device, since it becomes the structure which a carrier 120 moves between an external gear 116 and an internal gear 118, it is hard to respond to enlargement of the work pieces 121, such as the latest silicon wafer. That is, it is impossible to make the diameter of a carrier 120 larger than the radius of a surface plate, and the polished surface of a surface plate cannot be used efficiently. Moreover, with the double-sided polish equipment using the conventional epicyclic gear device, it is a complicated gear mechanism, and it will be difficult to enlarge and cost will increase an ingredient, processing, an arrangement tooth-space-problem, etc. and in respect of being various to manufacture large-sized equipment.

[0007] For this reason, the applicant for this patent has developed the following double-sided polish equipments as a background technique. Namely, the carrier with which a bore is prepared in a thin plate and the double-sided polish equipment grows into it, It is double-sided polish equipment equipped with the polished surface which moves relatively and grinds it to the wafer while inserting the wafer which is the tabular work piece arranged in the bore of the carrier from the upper and lower sides, the top board which it has, and a lower lapping plate. The carrier circular movement device in which carry out the circular motion which does not rotate said carrier in a field parallel to Men of a carrier through a carrier electrode holder, and turning migration of the wafer held between the top board and the lower lapping plate within said bore is carried out is provided. In addition, the top board and the lower lapping plate are prepared so that revolution (rotation) motion may be carried out respectively.

[0008] And in order to supply a liquefied abrasive material to the polish section which the polished surface and wafer of a top board and a lower lapping plate contact, and grinds the wafer, as shown in drawing 10 , natural drop of the liquefied abrasive material (slurry) is carried out. 39 is a slurry ring, and it is formed in the ring-like groove so that the slurry pumped up by the feeder of the liquefied abrasive material which is not illustrated may be stored. 39a is a supply pipe and is prepared as a duct which opens for free passage the slurry ring 39 and hole 14b for abrasive material supply prepared in the top board 14. A slurry passes and carries out natural drop of this supply pipe 39a, is

discharged from hole 14b for abrasive material supply, and is supplied to said polish section. In addition, 72 is a castellated shaft, and it is hung possible [vertical movement] while making a top board 14 rotate. 76 is a stationary plate and is being fixed to the soffit of a castellated shaft 72. Two or more splash bearing 78 which carries out the bearing of two or more soffits and lifting-and-holding shafts 79 of an air bag 77 rockable is being fixed to this stationary plate 76. Moreover, 80 is a movable plate, and while not being fixed to a castellated shaft 72, but being prepared possible [vertical movement] and the periphery section's serving as said slurry ring 39, an air bag's 77 upper bed and the upper bed of the lifting-and-holding shaft 79 by which the soffit was fixed to the top board 14 are being fixed. Therefore, if an air bag 77 is pressurized, the force of a direction of raising a top board 14 can be acquired, and the application-of-pressure load which a top board 14 gives to a wafer can be controlled. Moreover, according to an operation of the splash bearing 78, the polished surface of a top board 14 is made to follow in footsteps of the polished surface of a lower lapping plate 16 (refer to drawing 1), and it can tilt to it.

[0009]

[Problem(s) to be Solved by the Invention] However, with the double-sided polish equipment of the above-mentioned background technique, when a carrier 12 became a wrap gestalt extensively about a lower lapping plate 16 and supplied a liquefied abrasive material from hole 14b for abrasive material supply of a top board 14, the liquefied abrasive material collected on the carrier 12 upside, and did not flow below, but the technical problem that the polished surface of a lower lapping plate 16 was not fully supplied occurred. That is, extent which a slurry is beginning to leak and is supplied to the polished surface of a lower lapping plate 16 from few clearances between the inner skin of a bore and the peripheral faces of a work piece by which the work piece was held etc. was not enough as the amount of supply. On the other hand, as shown in drawing 1 or drawing 3 , when the free passage hole 15 for passing a slurry was formed in a carrier 12, fixed effectiveness was in it. However, it was difficult to flow only at the place which is easy to flow and to supply the slurry of sufficient flow rate extensively from spacing of each polished surface and the front face of a carrier 12 being dramatically narrow. It was difficult to supply a slurry near the center of each surface plate especially. Thus, by not supplying a slurry suitable for the polish section, the variation in temperature arises in the polished surface of each surface plate. This is because the polish heat by friction of a work piece and a polished surface cannot be cooled suitably, when the supply flow rate of a slurry is not enough. Thus, if the variation in temperature arises in a polished surface, polish conditions will change with each part of a work piece, and the polish precision of a work piece will be reduced as a result.

[0010] Then, the object of this invention is in double-sided polish equipment equipped with the carrier which carries out the circular motion which does not rotate, to the polish section which the polished surface and work piece of a top board and a lower lapping plate contact, and grinds the work piece, is enabling supply of the liquefied abrasive material of sufficient flow rate, and is to raise polish precision.

[0011]

[Means for Solving the Problem] This invention is equipped with the next configuration in order to attain the above-mentioned object. Namely, the top board and lower lapping plate which have the polished surface where moves relatively, and which is ground to this work piece while inserting the tabular work piece arranged in the bore of the carrier with which a bore is prepared in a thin plate and this invention grows into it, and this carrier from the upper and lower sides, The carrier circular movement device in which carry out the circular motion which does not rotate said carrier in a field parallel to Men of this carrier, and turning migration of said work piece held between the top board and the lower lapping plate within said bore is carried out, It has an abrasive material supply means to make said fed liquefied abrasive material discharge, from the hole for abrasive material supply prepared in the top board and/or the lower lapping plate that a liquefied abrasive material should be supplied to the polish section which said polished surface and work piece contact and grinds this work piece.

[0012] Moreover, it is in said abrasive material supply means, and two or more holes for said abrasive material supply are prepared in a location which is different about the direction of a path of a top board and/or a lower lapping plate, it becomes possible to cool the whole polished surface

surface with sufficient balance by two or more paths which supply said liquefied abrasive material corresponding to the hole for these two or more abrasive material supplies having been established, and lowering of the polish precision of the polished surface resulting from polish heat can be prevented more suitably.

[0013] Moreover, by rotation actuation being carried out a core [an axial center parallel to the direction which intersects perpendicularly with the field of said carrier], said top board and lower lapping plate can make a work piece, a top board, and a lower lapping plate exercise intricately relatively, and can improve polish precision.

[0014] Moreover, the carrier electrode holder with which said carrier circular movement device holds said carrier, The shaft by the side of the electrode holder which an axial center is parallel to the direction which intersects perpendicularly with the field of said carrier, and is fixed to revolve by said carrier electrode holder, And it has a shaft by the side of the base which keeps a predetermined distance and is fixed to revolve by the base while an axial center is parallel to the shaft by the side of this electrode holder. By providing the crank member to which the circular motion which does not rotate a carrier electrode holder to a base by making it circle in the shaft by the side of an electrode holder centering on the shaft by the side of said base is carried out, and the driving gear made to rotate this crank member centering on the shaft by the side of a base Though it is an easy configuration, the circular motion which does not rotate suitably the carrier held at the carrier electrode holder can be carried out.

[0015] Moreover, two or more said crank members are prepared, and a carrier can be made to exercise suitably and stably with an easy configuration by the shafts by the side of said base being coordinated by synchronous means, such as a timing chain, so that these two or more crank members may synchronize and it may move circularly.

[0016]

[Embodiment of the Invention] Hereafter, the suitable example of this invention is explained to a detail based on an accompanying drawing. Drawing 1 is the strabism exploded view having shown typically one example of the basic configuration concerning the double-sided polish equipment of this invention, and drawing 2 is the sectional side elevation showing the physical relationship of each configuration at the time of the example of drawing 1 operating. This example is double-sided polish equipment which grinds the wafer 10 of the silicon which is a tabular work piece, and is equipped with the top board 14 and lower lapping plate 16 which move relatively and grind it to a wafer 10 while inserting the carrier 12 with which bore 12a prepares and grows into a thin plate, and the wafer 10 arranged in the bore of the carrier 12 from the upper and lower sides. The abrasive cloth called a cross is attached to each front face of a top board 14 and a lower lapping plate 16, and polished surfaces 14a and 16a are formed in it by the abrasive cloth. Moreover, rotation actuation of the top board 14 and lower lapping plate 16 of this example is carried out a core [an axial center parallel to the direction which intersects perpendicularly with the field of a carrier 12]. The wafer 10 has fitted in loosely in circular and circular bore 12a, and has free size which can rotate in bore 12a. As for a carrier 12, what was formed for example, with the glass epoxy plate, and was set to 0 or about 7mm in thickness to the wafer 10 with a thickness of 0 or 8mm is common.

[0017] 20 is a carrier circular movement device and is an example of a motion device for which a carrier 12 is made to exercise for in a field parallel to Men of the carrier 12, and the wafer 10 held between the top board 14 and the lower lapping plate 16 within bore 12a is made to exercise. The carrier circular movement device 20 in this example carries out the circular motion which does not rotate a carrier 12 in a field parallel to Men of the carrier 12, and carries out turning migration of the wafer 10 which was held within bore 12a and pinched by the top board 14 and the lower lapping plate 16. That is, when not considering thickness of a carrier 12, the circular motion which does not rotate to the carrier 12 will be carried out in the same field as Men of a carrier 12. The concrete configuration of this carrier circular movement device 20 is explained below.

[0018] 22 is a carrier electrode holder, is formed in the shape of a ring, and holds the carrier 12. Here, a coordinated means 50 to coordinate a carrier 12 and the carrier electrode holder 22 is explained. Drawing 3 is an explanatory view ((a) is a top view and (b) is a sectional view) explaining the whole example gestalt of a carrier 12 and the carrier electrode holder 22, and drawing 4 is an important section expanded sectional view explaining an operation of the coordinated means of

drawing 3 . The coordinated means 50 is made to hold by making it coordinate with the carrier electrode holder 22 so that the elongation by the thermal expansion of the carrier 12 may be absorbed while the carrier 12 does not rotate a carrier 12. With the coordinated means 50 of this example, as shown in drawing 4 , it has the pin 23 prepared in the carrier electrode-holder 22 side, and hole 12b which path clearance was prepared in the direction of elongation by the thermal expansion of the carrier 12 (the direction of a path of the carrier 12 circular in this example), and was formed in the carrier 12 that it should fit loosely into a pin 23. The path clearance of hole 12b should just be formed in the slot that what is necessary is just to prepare suitable for the direction which absorbs the elongation by the thermal expansion of a carrier 12 at least.

[0019] Moreover, in this example, when it expands thermally also about the periphery edge, the carrier 12 is formed so that it can slide suitably, and path clearance may arise between inner skin 22a of the carrier electrode holder 22. That is, the outer diameter of a carrier 12 is formed in the predetermined dimension minor diameter rather than the bore of inner skin 22a. And it has set directly by inserting in the pin 23 of the carrier electrode holder 22 hole 12b of a carrier 12 which prepared path clearance in consideration of [having mentioned above] the thermal expansion of a carrier 12. Thus, a carrier 12 can be made to coordinate with an easy configuration suitable for the condition of having carried out the baffle to the carrier electrode holder 22, by having a coordinated means 50 to absorb the elongation by the thermal expansion of a carrier 12. Thereby, the elongation of a carrier 12 can be missed suitably, and can be absorbed and deformation of a carrier 12 can be prevented. Moreover, since a carrier 12 is a configuration with which it equips by inserting in the carrier electrode holder 22, the simplification of the activity at the time of wearing is made.

[0020] Next, the height adjustment function of the carrier 12 with which the carrier electrode holder 22 is equipped is explained. 23a is a flange and is prepared in the washer configuration at one at the halfway section of a pin 23. This flange 23a is prepared in the carrier electrode-holder 22 side, and has become the supporter supported directly that a carrier 12 should be held. Under the flange 23a of a pin 23, the pin 23 is formed in screw section 23b possible [wearing to lower-berth section 22b of the carrier electrode holder 22]. By adjusting the degree screwed in lower-berth section 22b of the screw section 23b carrier electrode holder 22, the height adjustment of flange 23a is prepared possible. Thus, by having prepared flange 23a, the height location of a carrier 12 can be adjusted suitably, and a carrier 12 can be appropriately held with the carrier electrode holder 22.

[0021] That is, when adjusting the height of flange 23a, and abrasive cloth 16a of a lower lapping plate 16 is exhausted and it becomes thin, it can respond to change of conditions suitably, and it can hold suitably so that a carrier 12 may not produce bending in the almost same height as the abrasive cloth 16a page of the lower lapping plate 16. Therefore, a carrier 12 can be held suitably horizontally and the grinding crack of a wafer 10 and polish precision degradation can be prevented. Moreover, by the front face of flange 23a, the peripheral face of a carrier 12 will be received selectively and sliding by telescopic motion of a carrier 12 can be supported suitably. That is, since the crawler bearing area of the peripheral face (underside) of a carrier 12 and the top face by the side of the carrier electrode holder 22 can be made small, sliding-friction resistance can be reduced and it can be suitably slid on a carrier 12. Thereby, the flexible force by the heat of a carrier 12 etc. is opened suitably, and generating of a carrier 12 of distortion can be prevented.

[0022] In the above example, although the support height of a carrier 12 was adjusted by adjusting the height of flange 23a of a pin 23, if it is the suitable means which it is needless to say that it is not restricted to this as for this invention, and can support a carrier 12 in predetermined height, especially the configuration will not be limited. For example, the supporter supported that the device in which you make it go up and down carrier electrode-holder 22 the very thing should be established, and a carrier 12 should be held may be the top face of lower-berth section 22b of the carrier electrode holder 22 fundamentally. In addition, the top face of lower-berth section 22b of irregularity being prepared is natural in order to raise slipping nature.

[0023] Next, other coordinated means which start this invention based on drawing 5 are explained. Drawing 5 (a) is a top view and drawing 5 (b) is a sectional view. As for this example, unlike said example, only the coordinated means 50 possesses the engaged portion 52 of the shape of an internal gear by which the coordinated means 50 was formed in the carrier electrode-holder 22 side, and the engagement section 42 of the shape of an external gear prepared in the carrier 12 side so that play

might be given to the engaged portion 52 and it might engage with it so that clearly [drawing]. That is, it is the gestalt which gave play and engaged the gear prepared in the periphery of a carrier 12, and the gear prepared in the inner circumference of the ring-like carrier electrode holder 22. A carrier 12 can be made to coordinate suitable for the carrier electrode holder 22 with an easy configuration also by this. And the same effectiveness as said example can be acquired.

[0024] Next, based on drawing 1 and drawing 2 , the example concerning each configuration of the carrier circular movement device 20 is explained. 24 is a crank member, and it is equipped with shaft 24b by the side of the base which keeps a predetermined distance and is fixed to revolve by the base 30 (refer to drawing 2) while an axial center is parallel to the axis L of a top board 14 and a lower lapping plate 16 and an axial center is parallel to shaft 24a by the side of the electrode holder fixed to revolve by the carrier electrode holder 22, and shaft 24a by the side of the electrode holder. That is, it is formed so that it may have the same function as the crank arm of a crank chain. In this example, this crank member 24 is making it circle in shaft 24a by the side of an electrode holder focusing on shaft 24b by the side of a base, and carries out the circular motion which does not rotate the carrier electrode holder 22 to a base 30 while it is allotted to four between a base 30 and the carrier electrode holder 22 and supports the carrier electrode holder 22. Shaft 24a by the side of an electrode holder is inserted in bearing 22c prepared in the peripheral face of the carrier electrode holder 22 by projecting pivotable, and is fixed to revolve. Thereby, a carrier 12 circles by M [eccentric] Carrying out from the axis L of a top board 14 and a lower lapping plate 16 (circular motion which does not rotate). The radius of the turning circular motion is the same as spacing (distance of eccentricity M) of shaft 24a by the side of an electrode holder, and shaft 24b by the side of a base, and all the points of a carrier 12 serve as motion describing the locus of the same small circle.

[0025] Moreover, 28 is a timing chain and is hung about on the sprocket 25 (this example four pieces) fixed to shaft 24b by the side of the base of each crank member 24 by the same axle. This timing chain 28 and four sprockets 25 constitute a synchronous means to coordinate shaft 24b by the side of four bases, and to synchronize them so that four crank members 24 may synchronize and move circularly. This synchronous means is an easy configuration and can make a carrier 12 exercise suitably and stably. By this, polish precision can be improved and the display flatness of a wafer can be improved. In addition, as a synchronous means, it is not restricted to this example and, of course, a timing belt or a gear may be used. 32 is a motor (for example, a GYADO motor or a servo motor), and 34 is the output gear fixed to the output shaft. The output gear 34 meshes with the gear 26 fixed to shaft 24b by the side of the base of the crank member 24 by the same axle. Thereby, the revolution driving gear made to rotate the crank member 24 focusing on shaft 24b by the side of a base is constituted.

[0026] In addition, two or more motors (for example, electric motor) arranged as a revolution driving gear respectively corresponding to each crank member 24 can also be used. If it is an electric motor, synchronous motion of two or more crank members 24 can be carried out, and a carrier 12 can be made to exercise smoothly by taking a synchronization electrically. Moreover, although this example explained the case where four crank members 24 were arranged, this invention can support the carrier electrode holder 22 suitably, if there are not only this but at least three crank members 24. Furthermore, if the mobile and said carrier electrode holder 22 of the X-Y table which can obtain two-dimensional motion are unified and it enables it to exercise by composition of a biaxial rectilinear motion which intersects perpendicularly, by actuation of one crank member 24, rotate, there is nothing and the circular motion of the carrier electrode holder 22 can be carried out. That is, by showing around with the guide prolonged in biaxial [biaxial and an X-Y table cross at right angles], said mobile carries out motion which does not rotate and can use motion of this mobile suitable for motion (circular motion which does not rotate) of the carrier electrode holder 22. Moreover, you may make it prepare a driving means in the X-Y table itself, not using the crank member 24 at all. That is, the carrier electrode holder 22 united with said mobile may be made to exercise by using the drive of the X-axis which consists of combination, such as a servo motor which makes the member of the X-axis and a Y-axis drive directly, respectively, a ball screw or a servo motor, and a timing chain, and a Y-axis (circular motion which does not rotate). In this case, although at least two motors will be used, the various two-dimensional motion which does not rotate besides the turning circular motion can be obtained by controlling a motor, and that motion can be

used for polish of a wafer 10.
[0027] 36 is a motor for a lower lapping plate revolution, and is a power plant which makes a lower lapping plate 16 rotate. For example, a GYADO motor or a servo motor can be used and the output shaft may be made to link with the revolving shaft of a lower lapping plate 16 directly. 38 is a power means for a top board revolution, and makes a top board 14 rotate. What is necessary is just to use suitably what serves as revolution power, such as an electric motor, like the motor 36 for a lower lapping plate revolution. The motor 36 for a lower lapping plate revolution and the power means 38 for a top board revolution can respond to the thing which can change a hand of cut and rotational speed freely, then various polish specifications flexibly. Moreover, with this double-sided polish equipment, the wafer 10 arranged in bore 12a of a carrier 12 is made sandwiches by the top board 14 and the lower lapping plate 16, as shown in drawing 2 , and polish processing of that wafer is made. Under the present circumstances, the force in which a wafer 10 is compressed is based on the application-of-pressure means mainly formed in the top board 14 side (refer to drawing 10). For example, pneumatic pressure is used, and the maximum welding pressure is the self-weight of a top board 14, and you may make it the air bag method made to act so that welding pressure may be reduced by raising pneumatic pressure adjust the thrust to the wafer 10 of a top board 14. This air bag method can adjust welding pressure suitably and easily by controlling pneumatic pressure. In addition, the lifting device 40 which moves vertically the top board 14 other than an application-of-pressure means is formed in a top board 14 side, and when it is feeding and discarding of a wafer 10, it operates.
[0028] Moreover, as shown in drawing 1 , 62 is a roller and is an example of a vibration isolation means to contact a top board 14 and to prevent the shake by the direction parallel to the field of the carrier 12 of the top board 14. The guide-idler body (not shown) prepared in about 14 top board on a base 30 is equipped with this roller 62 free [a revolution] so that periphery 14c of a top board 14 may be contacted suitably. With two or more of these rollers 62, by inserting a top board 14, in case a polish process is made, migration in a direction parallel to the field of the carrier 12 of a top board 14 is regulated, and an oscillation can be prevented.
[0029] Next, the supply means of a liquefied abrasive material is explained based on drawing 1 and drawing 3 . Hole 14b for abrasive material supply which supplies a slurry (liquefied abrasive material) to the polish section which a wafer 10 contacts polished surface 14a of the top board 14, and grinds this wafer 10 is prepared in the top board 14. Especially that gestalt or its number is not limited that hole 14b for this abrasive material supply just prepares a liquefied abrasive material in the polish section of a wafer 10 fully suitably in the magnitude which can supply homogeneity and does not have an adverse effect on that polish. In addition, 21 pieces are located in the shape of a matrix in total, each can open hole 14b for abrasive material supply of this example in a minor diameter, and it is prepared so that it may be distributed over a top board 14 at isodensity. In addition, hole 14b for abrasive material supply of this example is penetrated and prepared in the vertical direction at the top board 14. Moreover, although drawing 3 does not show, the tube etc. is connected with the upper bed of hole 14b for abrasive material supply like drawing 10 , and it is prepared so that the liquefied abrasive material pumped up with the pump etc. may be distributed suitably and may be supplied.
[0030] And the free passage hole 15 which supplies liquefied polish liquid to the polish section which the liquefied abrasive material supplied from hole 14b for abrasive material supply is passed, and a wafer 10 contacts polished surface 16a of a lower surface plate (lower lapping plate 16), and grinds this wafer 10 is formed in the carrier 12. That size, a configuration, or its number is not limited that this free passage hole 15 should just be formed in the location which does not affect the reinforcement of a carrier 12 at a suitable gestalt. In addition, in the example shown in drawing 3 , five circular free passage holes 15 have opened in the center of a carrier 12, and the circumferencial direction of a carrier 12 in total among ****** bore 12a.
[0031] According to this carrier 12, liquefied polish liquid can be supplied suitable for both sides of the wafer 10 ground, and can be ground suitably. That is, liquefied polish liquid can flow and fall from the free passage hole 15 which is an open beam hole to a carrier 12, and it can flow in suitable also for the rear face (field in contact with polished surface 16a) of a wafer 10. For this reason, polish conditions can be equalized and both sides of a wafer 10 can be ground with a sufficient

precision. In addition, like the case of conventional double-sided polish equipment, in the direction of a periphery, the liquefied polish liquid supplied on polished surface 16a overflows, is discharged, is collected further, and it circulates through it suitably from polished surface 16a one by one.
[0032] Next, based on drawing 6 - drawing 9 , the example of the abrasive material supply means which is the characteristic configuration of this invention is explained. Drawing 6 is a sectional view explaining the abrasive material supply means formed in the lower lapping plate. Drawing 7 is a sectional view explaining the abrasive material supply means formed in the top board. Moreover, it is an explanatory view explaining the abrasive material supply means which is formed in a top board and equips drawing 8 and drawing 9 with the supply path of two or more slurries (liquefied abrasive material). In addition, about the same configuration as the example explained above, the same sign is attached and explanation is omitted.
[0033] An abrasive material supply means to make the fed slurry discharge is shown in drawing 6 from hole 16b for abrasive material supply prepared in the lower lapping plate 16 that a liquefied abrasive material (slurry) should be supplied to the polish section which said polished surfaces 12a and 14a and said wafer 10 contact, and grinds the wafer 10. 85 is a feeding feeder which feeds a slurry and consists of a tank which stores a slurry, a pump which feeds a slurry. 86 is a free passage way and is constituted by horizontal pipe 86b which opens for free passage vertical tubing 86a which is allotted to the axial center of hollow rotation shaft 36a which makes a lower lapping plate 16 rotate in the vertical direction, and is open for free passage to hole 16b for abrasive material supply, its vertical tubing 86a, and the feeding feeder 85, the pipe joint, etc. The slurry pressurized by high voltage is sent through this free passage way 86, and it is breathed out from hole 16b for abrasive material supply. According to this abrasive material supply means, the slurry of sufficient flow rate can be compulsorily supplied to said polish section suitably (feeding), especially the polished surfaces 12a and 14a are cooled suitably, and the skin temperature of polished surfaces 12a and 14a can be equalized. In addition, the slurry breathed out from hole 16b for abrasive material supply prepared in the core of a lower lapping plate 16 flows from a core suitably to a periphery with a carrier eclipse and a centrifugal force to polished surface 16a of a lower lapping plate 16. For this reason, although hole 16b for abrasive material supply is one, enough many slurries can be suitably supplied to the whole polish section.
[0034] An abrasive material supply means to make the fed slurry discharge is shown in drawing 7 from hole 14b for abrasive material supply prepared in the top board 14 that a liquefied abrasive material (slurry) should be supplied to the polish section which said polished surfaces 12a and 14a and said wafer 10 contact, and grinds the wafer 10. 85a is a feeding feeder which feeds a slurry, and consists of a tank which stores a slurry, a pump which feeds a slurry. 87 is a free passage way and is constituted by branch pipe 87b which branches from vertical tubing 87a which is allotted to the axial center of hollow rotation shaft 38a which makes a top board 14 rotate in the vertical direction, and is open for free passage to feeding feeder 85a, and its vertical tubing 87a, and is open for free passage to hole 14b for abrasive material supply, the pipe joint, etc. The slurry pressurized by high voltage is sent through this free passage way 87, and it is breathed out from hole 14b for abrasive material supply. According to this abrasive material supply means, the slurry of sufficient flow rate can be compulsorily supplied to said polish section suitably (feeding), especially the polished surfaces 12a and 14a are cooled suitably, and the skin temperature of polished surfaces 12a and 14a can be equalized. In addition, of course, the abrasive material supply means shown in drawing 6 and the abrasive material supply means shown in drawing 7 may be used simultaneously, and the skin temperature of polished surfaces 12a and 14a can be equalized still more suitably.
[0035] Next, the operation effectiveness in the case of the ability to supply the slurry of sufficient flow rate to the polish section is explained by feeding a slurry like the example of drawing 6 and drawing 7 based on comparative experiments. About the case where a slurry 0.5l./m is supplied to the polish section, and the case where a slurry 3.0l./m is supplied to the polish section, the polish process of 1 time of a wafer was made into 60 minutes, and the polish process (it is 300 minutes by the grand total) of five batches was performed continuously, respectively. In addition, conditions other than the flow rate of a slurry presuppose that it is the same. Eight measure points were set as the location where the front faces (polished surface) of a lower lapping plate 16 differ radially, and it measured every 60 minutes about the skin temperature of each of that measure point including the

time of polish process initiation (0 minute). And it compared about the variation in the average value of the skin temperature at the time of measurement of each of that time, and the skin temperature between each measure point in every time of measurement of each time. Moreover, eight measure points were set as the location which was processed at each polish process and where the wafers differ radially for every wafer, the thickness of each of that measure point was measured, and it compared about the variation in the thickness of a wafer.

[0036] An experimental result is explained below. First, the skin temperature of a lower lapping plate 16 is explained. the case where 0.5l./m is supplied -- the mean temperature -- the time of polish initiation (0 minute) -- Centigrade -- the event of what was about 22 degrees passing 300 minutes -- Centigrade -- it went up even at about 34 degrees, and ****** of about 12 degrees arose in Centigrade. Moreover, the highest of the variation in the temperature between each measure point for every time of measurement of each time was about 3 times in Centigrade on the average about 5 times at Centigrade. On the other hand, when 3.0l./m was supplied, the mean temperature was almost regularity (difference of less than 1 time) in about 28 Centigrade through the time of all measurement, and the highest of the variation in the temperature between each measure point for every time of measurement of each time was 1 or less time on the average about 1.5 degrees in Centigrade.

[0037] Next, the variation in the thickness of the wafer by which polish processing was carried out is explained. When 0.5l./m was supplied, there was 1.3-micrometer variation in a maximum of 2.2 micrometers and an average. On the other hand, when 3.0l./m was supplied, in a maximum of 0.8 micrometers and an average, it was 0.6-micrometer variation. That is, the polish precision beyond twice was able to be acquired as compared with the case of 0.5l./m. Thus, when 3.0l./m was supplied, the polished surface could be maintained to homogeneity temperature and flattening of a remarkable wafer with a high precision was able to be performed. That is, while being able to prevent skin temperature (temperature of abrasive cloth side) lifting of the polished surfaces 14a and 16a of each surface plates 14 and 16 by increasing the amount of supply of a slurry, variation in the skin temperature of polished surfaces 14a and 16a can be made small. Thus, the polish precision of a wafer can be remarkably improved by maintaining the polish conditions about the skin temperature of polished surfaces 14a and 16a at homogeneity.

[0038] Next, based on drawing 8 and drawing 9 , an abrasive material supply means equipped with the supply path of two or more slurries is explained. Both of the examples are prepared in two or more locations where hole 14b for abrasive material supply differs about the direction of a path of a top board 14, it corresponds to hole 14b for the abrasive material supplies of two or more, and the path which supplies a slurry is prepared in two or more lines. A slurry is made to breathe out from hole 14b for each abrasive material supply in the example of drawing 8 through two or more supply paths 98a, 98b, and 98c which consist of ducts which pass along the inside of the distributor 89 formed in the revolving shaft, and a revolving shaft from two or more feeding feeders 88a, 88b, and 88c. In addition, a distributor 89 is a well-known technique which carries out the seal of the fluid and supplies it in the member to rotate. 97 is a sequencer and sends a command signal to two or more feeding feeders 88a, 88b, and 88c in response to the signal of the thermo sensors 99a, 99b, and 99c arranged near the hole 14b for each abrasive material supply. Feedback control of each supply paths 98a, 98b, and 98c is carried out by this about the flow rate of the slurry which flows and is breathed out from hole 14b for each abrasive material supply etc., polished surfaces 14a and 16a are cooled, and the skin temperature is maintained uniformly.

[0039] That is, each feeding feeders 88a, 88b, and 88c are equipped with the tank which adjusts the temperature of a slurry separately, the pump which can carry out adjustable [of the flow rate of the slurry to feed]. Therefore, by controlling each feeding feeders 88a, 88b, and 88c by the sequencer 97, the amount of supply of a slurry is raised to hole 14b for the abrasive material supply near [which the polish heat of polished surfaces 14a and 16a generates] the part, or the slurry of low temperature can be supplied to it. By this, corresponding to the heating situation like each part of polished surfaces 14a and 16a, it can cool suitably, the skin temperature can be equalized extensively, and the polish precision of a wafer can be improved remarkably.

[0040] Moreover, it is made to branch from 88d of feeding feeders, and a slurry is made to breathe out from hole 14b for each abrasive material supply in this example of drawing 9 through two or

more supply paths 98a, 98b, and 98c which consist of two or more automatic flow control valves 83a, 83b, and 83c, a distributor 89, a duct passing through the inside of a revolving shaft, etc. 97 is a sequencer and sends a command signal to two or more automatic flow control valves 83a, 83b, and 83c in response to the signal of the thermo sensors 99a, 99b, and 99c arranged near the hole 14b for each abrasive material supply. The flow rate of the slurry which flows each supply paths 98a, 98b, and 98c, and is breathed out from hole 14b for each abrasive material supply by this is controlled by two or more automatic flow control valves 83a, 83b, and 83c, polished surfaces 14a and 16a are cooled, and the skin temperature is maintained uniformly.

[0041] Thus, if the polish heat of polished surfaces 14a and 16a increases the amount of supply of a slurry to hole 14b for the abrasive material supply near [to generate / many] the part by controlling each automatic flow control valves 83a, 83b, and 83c by the sequencer 97, corresponding to the heating situation like each part of polished surfaces 14a and 16a, it can cool suitably, and the skin temperature can be equalized extensively. Therefore, the polish precision of a wafer can be improved remarkably. In addition, as for an exchange of the signal of a sequencer 97, and a thermo sensor and a feeding feeder or an automatic flow control valve, it is needless to say that wiring may perform like this example and wireless can perform. Moreover, the pressure which feeds a slurry is 2-3kg/cm2. With extent, although it is good, you may make it high voltage further. Moreover, although the above example explained the case where the supply path of two or more slurries was prepared in a top board 14, not only this but this invention can be prepared in a lower lapping plate 16.

[0042] Next, an example of the operation of the double-sided polish equipment concerning this invention is explained. First, the case where a top board 14 and a lower lapping plate 16 are rotated to an opposite direction although the absolute value of rotational speed is the same is explained without making a carrier 12 exercise. That is, as shown in drawing 1 , a top board 14 carries out a clock revolution, and carries out the counter clockwise of the lower lapping plate 16. In this case, since frictional force completely acts on an opposite direction, that motion force is offset mutually, and after the wafer 10 has stopped, double-sided polish is made theoretically. However, in this case, by the top board 14 and the lower lapping plate 16, that peripheral velocity becomes large, so that it goes to that periphery. Therefore, polish is promoted and a wafer 10 is not ground for the further part from the part corresponding to the axis L of the top board 14 of a wafer 10, and a lower lapping plate 16 by homogeneity.

[0043] Next, scouring by carrying out the circular motion which does not rotate according to the motion device which consists of a configuration of having mentioned the carrier 12 above is explained. When the revolution of a top board 14 and a lower lapping plate 16 is not considered but only the circular motion to which a carrier 12 does not rotate is considered, according to the circular motion which does not rotate, all the motion completely same in respect of the member (carrier 12) which exercises will be made. This is the semantics from which all points serve as the same motion, is a kind of splash motion, and should just think that the locus of splash motion became a circle. Therefore, if turning migration of the wafer 10 is carried out through the carrier 12 which carries out the circular motion which does not rotate and it will say only within the operation by this motion, both sides of a wafer 10 will be ground by homogeneity.

[0044] And when operating simultaneously rotation of a top board 14 and a lower lapping plate 16, and the circular motion to which a carrier 12 does not rotate Since the wafer 10 is held pivotable in bore 12a, when it distinguishes between the absolute value of the rotational speed of a top board 14 and a lower lapping plate 16 especially (when rotational speed of the surface plate of another side is made quick to one surface plate), A wafer 10 is carried out the circumference of a companion to the hand of cut of the surface plate of a side with the quick rotational speed. That is, a wafer 10 will rotate in the predetermined direction. Thus, although the peripheral velocity is large at the top board 14 and the lower lapping plate 16 so that it goes to the periphery because a wafer 10 rotates, the effect can be lost and a wafer 10 can be ground to homogeneity. In addition, what is necessary is just to control the rotational speed of a top board 14 and a lower lapping plate 16 so that one side becomes quick by turns in order to grind both sides of a wafer 10 to homogeneity.

[0045] Next, other examples of the operation of the double-sided polish equipment concerning this invention are explained. Although the above example explained the case where two or more bore 12a was prepared, and two or more work pieces (wafer 10) were ground simultaneously, in this

invention, only a piece prepares bore 12a by which a large-sized work piece is held not only in this but in the carrier 12, and it can use also as polish equipment which grinds both sides of the large-sized work piece. In addition, there are work pieces, such as a wafer (circular) processed by the rectangle-like glass plate used for liquid crystal or the sheet as a large-sized work piece. In this case, a large-sized work piece will be arranged almost extensively ranging from the core to near [that] near the periphery of a carrier 12. It grinds at this time, mainly using the circular motion by the carrier 12 which does not rotate, and the rotational speed of a top board 14 and a lower lapping plate 16 can be ground uniformly and suitably about the whole work-piece side, if it is made late to extent which polish unevenness does not generate. That is, although scouring becomes large, if the rotational speed is dramatically as slow as a periphery compared with the circular motion to which a carrier 12 does not rotate, it can avoid making it almost participate in scouring directly by the difference in peripheral velocity at a top board 14 and a lower lapping plate 16. And since scouring is made good, rotating a top board 14 and a lower lapping plate 16 making the surface plate side in contact with a work piece always update, and supplying a liquefied abrasive material to the whole surface of a work piece on the average etc. can contribute suitably indirectly.

[0046] Although the above example explained polishing equipment, as for this invention, it is needless to say that it is applicable suitable also for wrapping equipment. as mentioned above, although the suitable example was given per this invention and many things have been explained, this invention is not limited to this example and comes out not to mention the ability to change many within limits which do not deviate from the pneuma of invention.

[0047]

[Effect of the Invention] According to the double-sided polish equipment of this invention, the fed liquefied abrasive material is made to discharge from the hole for abrasive material supply prepared in the top board and/or the lower lapping plate that a liquefied abrasive material should be supplied to the polish section which the polished surface and work piece of a top board and a lower lapping plate contact, and grinds this work piece with an abrasive material supply means. Since according to this it is in double-sided polish equipment equipped with the carrier which carries out the circular motion which does not rotate, it becomes possible to supply the liquefied abrasive material of sufficient flow rate to said polish section and the skin temperature of said polished surface can be maintained to homogeneity, the higher efficacy that polish precision can be raised is done so.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the strabism exploded view of one example of the double-sided polish equipment concerning this invention.
[Drawing 2] It is the sectional side elevation of the example of drawing 1 .
[Drawing 3] It is the top view and sectional view showing the carrier of the example of drawing 1 , and the whole carrier electrode holder.
[Drawing 4] It is a sectional view explaining the important section of the coordinated means concerning this invention.
[Drawing 5] It is the top view and sectional view showing other examples of the coordinated means concerning this invention.
[Drawing 6] It is a sectional view explaining one example of the abrasive material supply means concerning this invention.
[Drawing 7] It is a sectional view explaining other examples of the abrasive material supply means concerning this invention.
[Drawing 8] It is an explanatory view explaining one example of an abrasive material supply means equipped with two or more paths.
[Drawing 9] It is an explanatory view explaining other examples of an abrasive material supply means equipped with two or more paths.
[Drawing 10] It is a sectional view explaining the abrasive material supply means of a background technique.
[Drawing 11] It is a sectional view explaining the conventional technique.
[Drawing 12] It is a top view explaining arrangement of the carrier of the conventional technique.
[Description of Notations]
10 Wafer
12 Carrier
12a Bore
12b Hole
14 Top Board
14a Polished surface
14b The hole for abrasive material supply
15 Free Passage Hole
16 Lower Lapping Plate
16a Polished surface
20 Carrier Circular Movement Device
22 Carrier Electrode Holder
23 Pin
24 Crank Member
24a The shaft by the side of an electrode holder
24b The shaft by the side of a base
28 Timing Chain
30 Base
32 Motor

40 Lifting Device of Top Board
85 Feeding Supply Means
85a Feeding supply means
86 Free Passage Way
87 Free Passage Way
88a, 88b, 88c Feeding supply means
88d Feeding supply means
89 Distributor
97 Sequencer
98a, 98b, 98c Supply path
99a, 99b, 99c Thermo sensor

[Translation done.]

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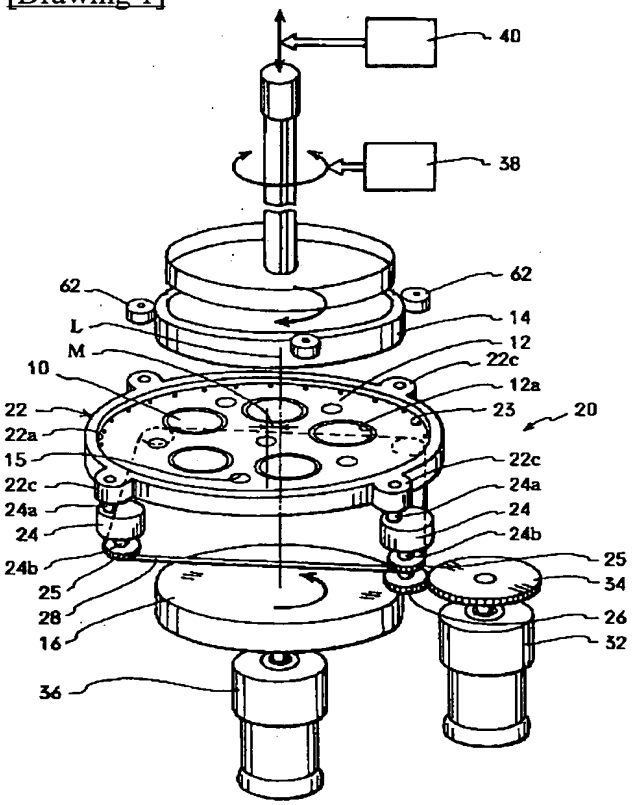
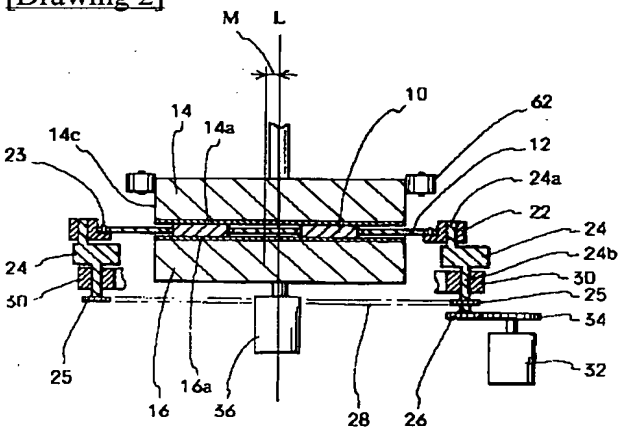
3.In the drawings, any words are not translated.

DRAWINGS

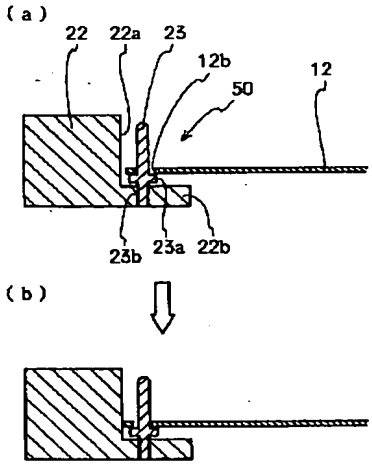
[Drawing 1]



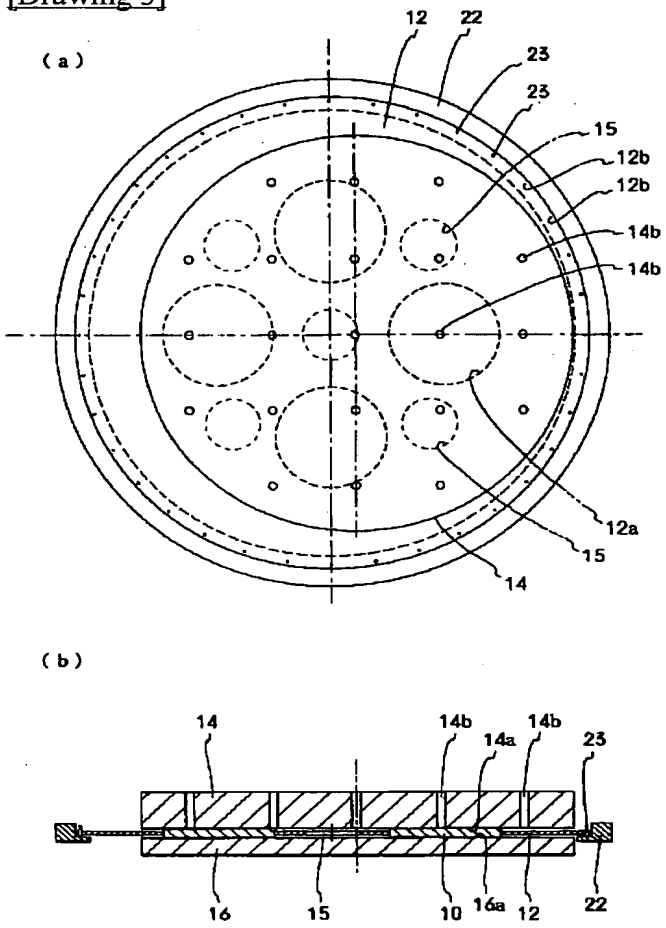
[Drawing 2]



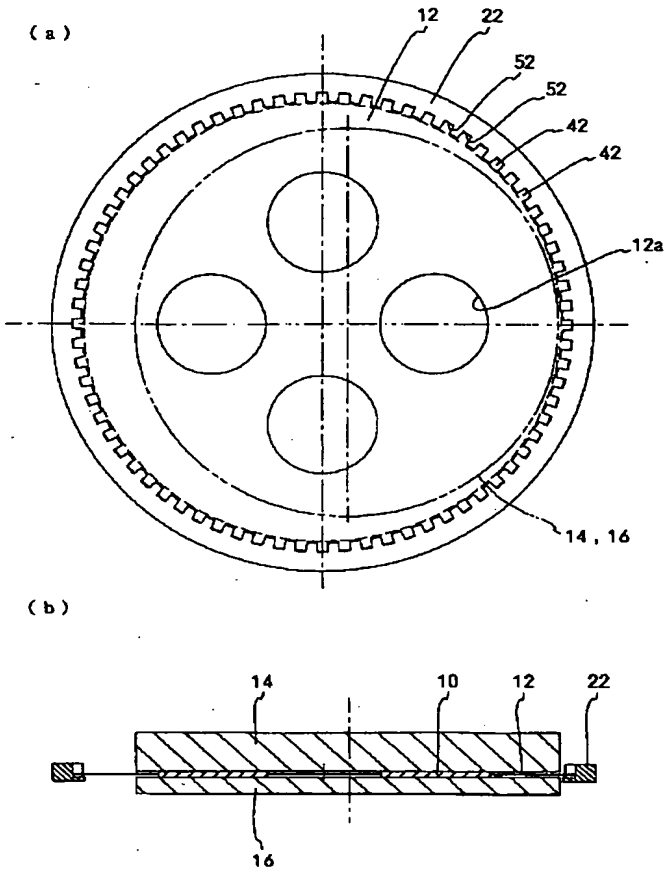
[Drawing 4]



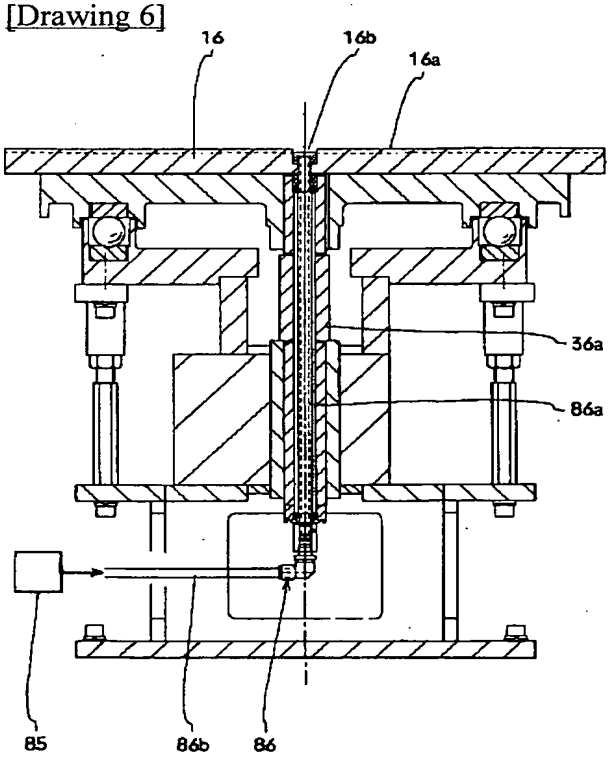
[Drawing 3]



[Drawing 5]



[Drawing 6]



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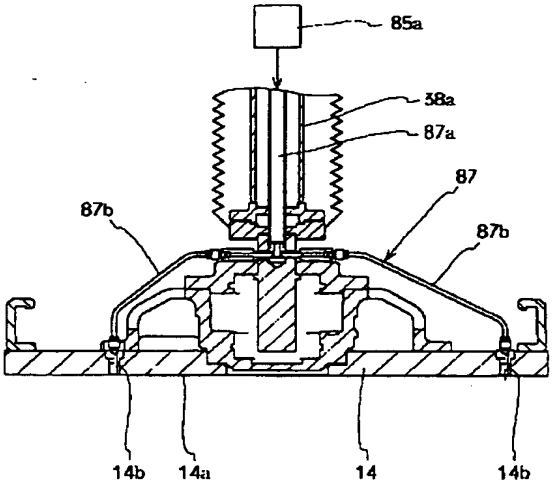
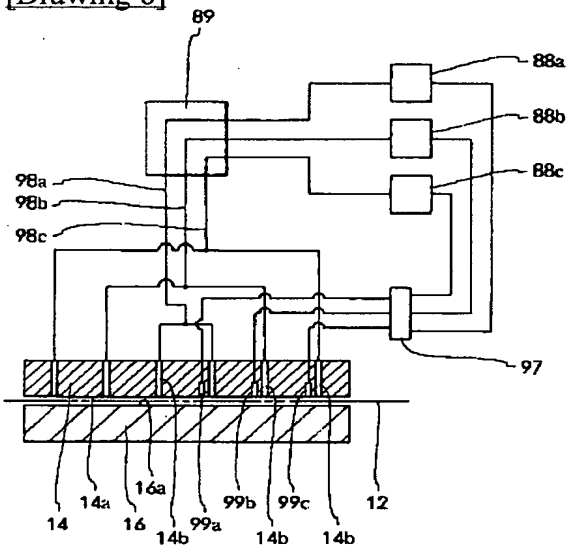
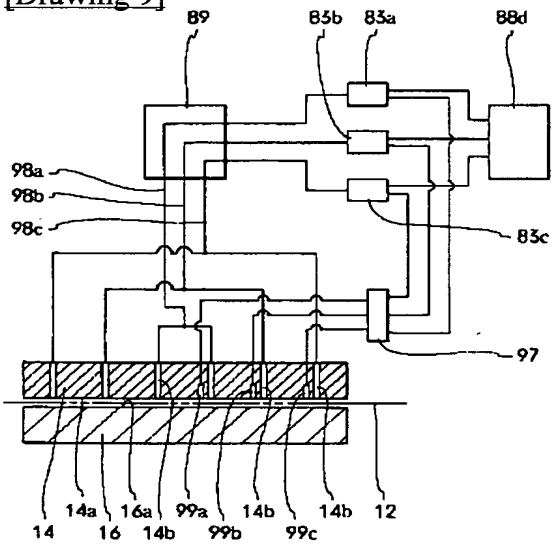


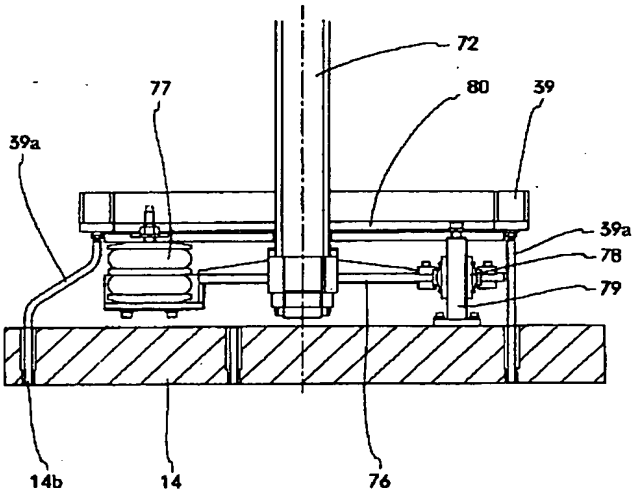
[Drawing 8]



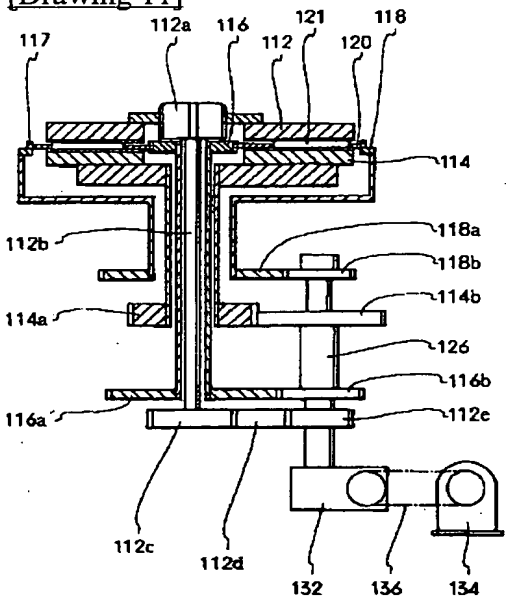
[Drawing 9]



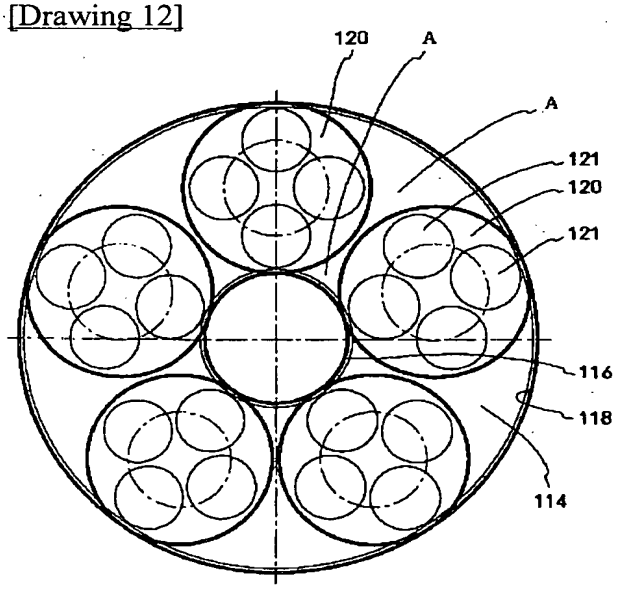
[Drawing 10]



[Drawing 11]



[Drawing 12]



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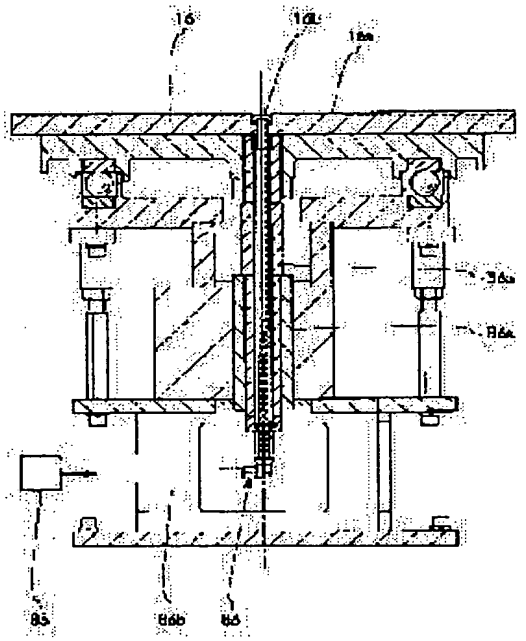
(54) DOUBLE-SIDE POLISHING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To supply a liquid abrasive of a sufficient flow rate to the polishing part by forcibly sending the liquid abrasive from an abrasive supply hole arranged in an upper surface plate and/or a lower surface plate.
SOLUTION: An abrasive supply hole 16b is arranged in a lower surface plate 16. A forcibly sending supply device 85 for forcibly sending slurry is composed of a slurry storage tank and a slurry sending pump. A communicating passage 86 is composed of a vertical pipe 86a communicating with the hole 16b by passing through into a hollow autorotating shaft 36a, a horizontal pipe 86b communicating the vertical pipe 86a with the sending supply device 85 and a pipe joint. The slurry pressurized to high pressure is sent through this communicating passage 86 to be delivered from the abrasive supply hole 16b. Since the slurry delivered from the abrasive supply hole 16b flows to the outer periphery from the central part by centrifugal force by being received to the polishing surface of the lower surface plate 16 by this abrasive supply means, the slurry can be sufficiently supplied to the whole polishing part.



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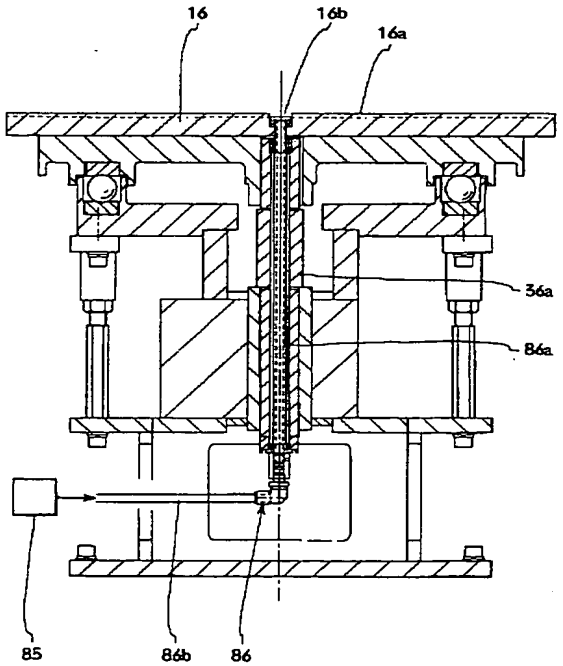
最終頁に続く

(54)【発明の名称】　両面研磨装置

(57)【要約】
【課題】　自転しない円運動をするキャリヤを備える両面研磨装置にあって、上定盤及び下定盤の研磨面とワークが接触してそのワークを研磨する研磨部へ、十分な流量の液状の研磨剤を供給し、研磨精度を向上させること。
【解決手段】　薄平板に透孔が設けられて成るキャリヤと、ワークに対して相対的に移動して研磨する研磨面を有する上定盤及び下定盤１６と、前記キャリヤを自転しない円運動をさせ、前記透孔内で上定盤と下定盤１６との間に保持された前記ワークを旋回移動させるキャリヤ旋回運動機構と、前記研磨面とワークが接触して該ワークを研磨する研磨部へ液状の研磨剤を供給すべく、下定盤１６に設けた研磨剤供給用の孔１６ｂから、前記液状の研磨剤を排出させるよう、圧送する圧送供給手段８５とを備える。



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【特許請求の範囲】

【請求項１】　薄平板に透孔が設けられて成るキャリヤと、

該キャリヤの透孔内に配された板状のワークを、上下から挟むと共に該ワークに対して相対的に移動して研磨する研磨面を有する上定盤及び下定盤と、

前記キャリヤを、該キャリヤの面と平行な面内で自転しない円運動をさせ、前記透孔内で上定盤と下定盤との間に保持された前記ワークを旋回移動させるキャリヤ旋回運動機構と、

前記研磨面とワークが接触して該ワークを研磨する研磨部へ液状の研磨剤を供給すべく、上定盤及び／又は下定盤に設けた研磨剤供給用の孔から、圧送された前記液状の研磨剤を排出させる研磨剤供給手段とを備えることを特徴とする両面研磨装置。

【請求項２】　前記研磨剤供給手段にあって、前記研磨剤供給用の孔が、上定盤及び／又は下定盤の径方向について異なる位置に複数設けられ、該複数の研磨剤供給用の孔に対応して前記液状の研磨剤を供給する経路が複数設けられたことを特徴とする請求項１記載の両面研磨装置。

【請求項３】　前記上定盤及び下定盤は、前記キャリヤの面に直交する方向に平行な軸心を中心に自転駆動されることを特徴とする請求項１又は２記載の両面研磨装置。

【請求項４】　前記キャリヤ旋回運動機構は、

前記キャリヤを保持するキャリヤホルダーと、

前記キャリヤの面に直交する方向に軸心が平行であって前記キャリヤホルダーに軸着されるホルダー側の軸、及び該ホルダー側の軸に軸心が平行であると共に所定の距離をおいて基体に軸着される基体側の軸を備え、前記基体側の軸を中心にホルダー側の軸を旋回させることでキャリヤホルダーを基体に対して自転しない円運動をさせるクランク部材と、

該クランク部材を基体側の軸を中心に回転させる駆動装置とを具備することを特徴とする請求項１、２又は３記載の両面研磨装置。

【請求項５】　前記クランク部材が複数設けられ、該複数のクランク部材は同期して円運動するよう、前記基体側の軸同士がタイミングチェーン等の同期手段によって連繋されていることを特徴とする請求項４記載の両面研磨装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は両面研磨装置に関する。両面研磨装置としては、従来から、エクスターナルギヤ（以下、「外歯車」という）とインターナルギヤ（以下、「内歯車」という）を異なる角速度で回転することによって、加工材料（以下、「ワーク」という）を担持した遊星歯車に相当するキャリヤを自転させるとともに公転させ、そのキャリヤの上下に配された研磨面を有する上定盤及び下定盤が、ワークを上下から挟むと共にワークに対して相対的に移動して研磨する遊星歯車機構を用いたものがある。この両面研磨装置は、ラッピング装置（ラップ盤）、またはポリシング装置として使用され、精度が高く、両面を同時に研磨できるため加工時間が短くて済み、半導体チップの素材となるシリコンウェーハ等の薄物研磨加工に適している。

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【０００２】

【従来の技術】従来の遊星歯車機構を用いたポリシング装置の構成について、図１１に基づいて説明する。１１２は上定盤、１１４は下定盤であり、それぞれの表面には研磨布（クロス）が付けられており、その研磨布によって研磨面が形成されている。１１６は外歯車、１１８は内歯車である。また、１２０はキャリヤであり、このキャリヤ１２０に穿設された透孔内にワーク１２１が保持され、外歯車１１６と内歯車１１８と噛み合って回転する。上定盤１１２は上定盤回し金１１２ａに連繋され、この上定盤回し金１１２ａから垂下したシャフト１１２ｂの先端にギヤ１１２ｃが設けられている。ギヤ１１２ｃはアイドルギヤ１１２ｄに、そのアイドルギヤ１１２ｄはギヤ１１２ｅに噛合している。このギヤ１１２ｅは、スピンドル１２６と一体に回転すべく、スピンドル１２６と同軸に設けられている。下定盤１１４は、その下定盤１１４に同軸に設けられたギヤ１１４ａを介し、スピンドル１２６に同軸に設けられたギヤ１１４ｂに連繋している。外歯車１１６は、その外歯車１１６に同軸に設けられたギヤ１１６ａを介し、スピンドル１２６に同軸に設けられた伝達ギヤ１１６ｂに連繋している。内歯車１１８は、その内歯車１１８に同軸に設けられたギヤ１１８ａを介し、スピンドル１２６に同軸に設けられた伝達ギヤ１１８ｂに連繋している。すなわち、このポリシング装置は、一つの駆動装置によって、外歯車１１６、内歯車１１８、上定盤及び下定盤１１２、１１４を回転駆動させる、いわゆる４ウェイ駆動方式となっている。なお、スピンドル１２６は可変減速機１３２に連結され、その可変減速機１３２は、ベルト１３６を介してモータ１３４と連結されており、スピンドル１２６の回転速度を制御する。

【０００３】この遊星歯車機構を用いたポリシング装置によれば、例えば、外歯車１１６の角速度に比べて内歯車１１８の角速度の方が大きくなるようにギヤ１１６ａと伝達ギヤ１１６ｂの回転比、及びギヤ１１８ａと伝達ギヤ１１８ｂの回転比がそれぞれ設定されている場合、外歯車１１６と内歯車１１８との間に噛合したキャリヤ１２０は、内歯車１１８の回転方向と同一方向（例えば、「反時計方向」とする）に公転し、且つ時計方向に自転する。また、下定盤１１４も同じく反時計方向に回転するが、上定盤１１２はアイドルギヤ１１２ｄが介在するので時計方向に回転する。なお、研磨条件に応じ

て、キャリヤ１２０の回転方向及び回転速度等は、外歯車１１６と内歯車１１８の角速度の設定によって変更することができる。

【０００４】また、ワーク１２１の表裏の研磨面へは、砥粒等を含む液状の研磨剤が供給され、その液状の研磨剤の作用によってワーク１２１の研磨が好適になされる。シリコンウェーハの研磨では、通常、アルカリ性の研磨液に砥粒が分散されてなる研磨剤（通称「スラリー」）が、シリコンウェーハと研磨用定盤の研磨面との間に供給されて研磨がなされる。液状の研磨剤を供給する方法としては、上定盤１１２に上下方向へ貫通して設けられた研磨剤供給用の孔を介し、液状の研磨剤を上方からポンプ動力及び重力を利用して滴下させて供給することが一般的になされている。研磨剤供給用の孔から吐出した液状の研磨剤は、上定盤１１２の研磨面とワーク１２１が接触してそのワーク１２１を研磨する研磨部へ供給されると共に、隣合うキャリヤ１２０同士の間を通過して下定盤１１４の研磨面上へ流れ、下定盤１１４の研磨面とワーク１２１が接触してそのワーク１２１を研磨する研磨部へ供給される。

【０００５】図１２は、図１１のポリシング装置にかかるキャリヤ１２０の配置例を説明する平面図であり、隣合うキャリヤ１２０同士の間には空隙部Ａがある。この空隙部Ａは内径部にも外径部にも十分な広さで存在し、液状の研磨剤は下定盤１１４の研磨面上へも好適に供給される。このように、液状の研磨剤は、簡単な上方からの供給手段によって、ワーク１２１の両面について十分に供給される。このポリシング装置によれば、液状の研磨剤を好適に供給でき、キャリヤ１２０を複雑に運動させることができるため、研磨むらを防止して均一にワーク１２１（例えば、シリコンウェーハ）研磨できる。従って、ワークの平坦度を向上できる。また、ワーク１２１の両面を同時に研磨できるため、研磨効率を向上できる。

【０００６】しかしながら、上記従来の遊星歯車機構を用いた両面研磨装置では、キャリヤ１２０が外歯車１１６と内歯車１１８の間で移動する構造になるため、最近のシリコンウェーハ等のワーク１２１の大型化に対応しにくい。すなわち、キャリヤ１２０の直径を、定盤の半径より大きくすることは不可能であり、定盤の研磨面を効率良く利用することができない。また、従来の遊星歯車機構を用いた両面研磨装置では、複雑な歯車機構となっており、大型化することが難しく、大型の装置を製造するには材料、加工、配置スペース的な問題など、様々な面でコストが嵩んでしまう。

【０００７】このため、本願出願人は、背景技術として次のような両面研磨装置を開発してある。すなわち、その両面研磨装置は、薄平板に透孔が設けられて成るキャリヤと、そのキャリヤの透孔内に配された板状のワークであるウェーハを、上下から挟むと共にそのウェーハに対して相対的に移動して研磨する研磨面と有する上定盤及び下定盤とを備える両面研磨装置であって、前記キャリヤを、キャリヤホルダーを介してキャリヤの面と平行な面内で自転しない円運動をさせ、前記透孔内で上定盤と下定盤の間に保持されたウェーハを旋回移動させるキャリヤ旋回運動機構を具備する。なお、上定盤及び下定盤は、各々回転（自転）運動するように設けられている。

【０００８】そして、上定盤及び下定盤の研磨面とウェーハが接触してそのウェーハを研磨する研磨部へ液状の研磨剤を供給するには、図１０に示すように、液状の研磨剤（スラリー）を自然落下させている。３９はスラリーリングであり、図示しない液状の研磨剤の供給装置によって汲み上げられたスラリーを貯留するように、リング状の溝状に形成されている。３９ａは供給管であり、スラリーリング３９と上定盤１４に設けた研磨剤供給用の孔１４ｂとを連通する管路として設けられている。スラリーは、この供給管３９ａを通過して自然落下し、研磨剤供給用の孔１４ｂから排出されて前記研磨部に供給されるようになっている。なお、７２はスプライン軸であり、上定盤１４を自転させると共に上下動可能に吊り下げている。７６は固定板であり、スプライン軸７２の下端に固定されている。この固定板７６には、複数のエアバック７７の下端と、吊持シャフト７９を揺動可能に軸受けする複数の揺動軸受７８が固定されている。また、８０は可動板であり、スプライン軸７２に固定されず上下動可能に設けられ、外周部が前記スラリーリング３９となっていると共に、エアバック７７の上端と、下端が上定盤１４に固定された吊持シャフト７９の上端が固定されている。従って、エアバック７７を加圧すれば、上定盤１４を持ち上げる方向の力を得ることができ、上定盤１４がウェーハに与える加圧荷重をコントロールできる。また、揺動軸受７８の作用によって、下定盤１６（図１参照）の研磨面に上定盤１４の研磨面を追随させて傾動できる。

【０００９】

【発明が解決しようとする課題】しかしながら、上記背景技術の両面研磨装置では、キャリヤ１２が下定盤１６を全面的に覆う形態となり、液状の研磨剤を上定盤１４の研磨剤供給用の孔１４ｂから供給した場合、その液状の研磨剤が、キャリヤ１２の上側に溜まってしまい下方へ流れず、十分に下定盤１６の研磨面に供給されないという課題があった。すなわち、ワークが保持された透孔の内周面とワークの外周面との僅かな隙間等から、スラリーが漏れ出して下定盤１６の研磨面へ供給される程度で、その供給量は十分でなかった。これに対して、図１又は図３に示すように、キャリヤ１２に、スラリーを通過させるための連通孔１５を設けた場合、一定の効果があった。しかし、各研磨面とキャリヤ１２の表面の間隔が非常に狭いことから、流れ易いところだけに流れてし

まい、十分な流量のスラリーを全面的に供給することは困難であった。特に、各定盤の中央付近に、スラリーを供給することが難しかった。このようにスラリーが研磨部に好適に供給されないことによって、各定盤の研磨面に温度のバラツキが生じる。これは、スラリーの供給流量が十分でない場合、ワークと研磨面の摩擦による研磨熱を好適に冷却できないことによる。このように研磨面に温度のバラツキが生じると、研磨条件がワークの各部によって異なることになり、結果的にワークの研磨精度を低下させてしまうのである。

【００１０】そこで、本発明の目的は、自転しない円運動をするキャリヤを備える両面研磨装置にあって、上定盤及び下定盤の研磨面とワークが接触してそのワークを研磨する研磨部へ、十分な流量の液状の研磨剤を供給可能にすることで、研磨精度を向上させることにある。

【００１１】

【課題を解決するための手段】上記の目的を達成するため、本発明は次の構成を備える。すなわち、本発明は、薄平板に透孔が設けられて成るキャリヤと、該キャリヤの透孔内に配された板状のワークを、上下から挟むと共に該ワークに対して相対的に移動して研磨する研磨面を有する上定盤及び下定盤と、前記キャリヤを、該キャリヤの面と平行な面内で自転しない円運動をさせ、前記透孔内で上定盤と下定盤との間に保持された前記ワークを旋回移動させるキャリヤ旋回運動機構と、前記研磨面とワークが接触して該ワークを研磨する研磨部へ液状の研磨剤を供給すべく、上定盤及び／又は下定盤に設けた研磨剤供給用の孔から、圧送された前記液状の研磨剤を排出させる研磨剤供給手段とを備える。

【００１２】また、前記研磨剤供給手段にあって、前記研磨剤供給用の孔が、上定盤及び／又は下定盤の径方向について異なる位置に複数設けられ、該複数の研磨剤供給用の孔に対応して前記液状の研磨剤を供給する経路が複数設けられたことで、研磨面全面をバランスよく冷却することが可能になり、研磨熱に起因する研磨面の研磨精度の低下をより好適に防止できる。

【００１３】また、前記上定盤及び下定盤は、前記キャリヤの面に直交する方向に平行な軸心を中心に自転駆動されることで、ワークと上定盤及び下定盤とを相対的に複雑に運動させることができ、研磨精度を向上できる。

【００１４】また、前記キャリヤ旋回運動機構は、前記キャリヤを保持するキャリヤホルダーと、前記キャリヤの面に直交する方向に軸心が平行であって前記キャリヤホルダーに軸着されるホルダー側の軸、及び該ホルダー側の軸に軸心が平行であると共に所定の距離をおいて基体に軸着される基体側の軸を備え、前記基体側の軸を中心にホルダー側の軸を旋回させることでキャリヤホルダーを基体に対して自転しない円運動をさせるクランク部材と、該クランク部材を基体側の軸を中心に回転させる駆動装置とを具備することで、簡単な構成でありながら、キャリヤホルダーに保持されたキャリヤを好適に自転しない円運動をさせることができる。

【００１５】また、前記クランク部材が複数設けられ、該複数のクランク部材は同期して円運動するよう、前記基体側の軸同士がタイミングチェーン等の同期手段によって連繋されていることで、簡単な構成でキャリヤを好適且つ安定的に運動させることができる。

【００１６】

【発明の実施の形態】以下、本発明の好適な実施例を添付図面に基づいて詳細に説明する。図１は本発明の両面研磨装置にかかる基本構成の一実施例を模式的に示した斜視分解図であり、図２は図１の実施例が作動している際の各構成の位置関係を示す側断面図である。本実施例は、板状のワークであるシリコンのウェーハ１０を研磨する両面研磨装置であり、薄平板に透孔１２ａが設けられて成るキャリヤ１２と、そのキャリヤ１２の透孔内に配されたウェーハ１０を、上下から挟むと共にウェーハ１０に対して相対的に移動して研磨する上定盤１４及び下定盤１６とを備える。上定盤１４及び下定盤１６のそれぞれの表面には、クロスと呼ばれる研磨布が付けられており、その研磨布によって研磨面１４ａ、１６ａが形成されている。また、本実施例の上定盤１４及び下定盤１６は、キャリヤ１２の面に直交する方向に平行な軸心を中心に自転駆動される。ウェーハ１０は、円形であり円形の透孔１２ａ内に遊嵌されており、透孔１２ａの中ではフリーに自転可能なサイズになっている。キャリヤ１２は、例えば、ガラスエポキシ板で形成され、厚さ０、８ｍｍのウェーハ１０に対して厚さ０、７ｍｍ程度に設定されたものが一般的である。

【００１７】２０はキャリヤ旋回運動機構であり、キャリヤ１２を、そのキャリヤ１２の面と平行な面内で運動をさせ、透孔１２ａ内で上定盤１４と下定盤１６との間に保持されたウェーハ１０を運動させる運動機構の一例である。本実施例におけるキャリヤ旋回運動機構２０は、キャリヤ１２を、そのキャリヤ１２の面と平行な面内で自転しない円運動をさせ、透孔１２ａ内で保持されて上定盤１４と下定盤１６とによって挟持されたウェーハ１０を旋回移動させる。すなわち、キャリヤ１２の厚さを考えない場合に、キャリヤ１２の面と同一の面内で、そのキャリヤ１２に自転しない円運動をさせることになる。このキャリヤ旋回運動機構２０の具体的な構成について以下に説明する。

【００１８】２２はキャリヤホルダーであり、リング状に形成されており、キャリヤ１２を保持している。ここで、キャリヤ１２とキャリヤホルダー２２とを連繋する連繋手段５０について説明する。図３はキャリヤ１２とキャリヤホルダー２２の一例の全体形態を説明する説明図（（ａ）は平面図、（ｂ）は断面図）であり、図４は図３の連繋手段の作用を説明する要部拡大断面図である。連繋手段５０は、キャリヤ１２を、そのキャリヤ１

２が自転しないと共に、そのキャリヤ１２の熱膨張による伸びを吸収するように、キャリヤホルダー２２へ連繋させることで保持させている。本実施例の連繋手段５０では、図４に示すように、キャリヤホルダー２２側に設けられたピン２３と、ピン２３に遊嵌すべくキャリヤ１２にそのキャリヤ１２の熱膨張による伸び方向（本実施例では円形のキャリヤ１２の径方向）へクリアランスが設けられて形成された穴１２ｂとを備える。穴１２ｂのクリアランスは、少なくともキャリヤ１２の熱膨張による伸びを吸収する方向に好適に設ければよく、例えば、長穴に形成されていればよい。

【００１９】また、本実施例において、キャリヤ１２は、その外周縁についても熱膨張した際に好適にスライドできるように、キャリヤホルダー２２の内周面２２ａとの間にクリアランスが生じるように形成されている。すなわち、内周面２２ａの内径よりもキャリヤ１２の外径が、所定の寸法小径に形成されている。そして、上述したようにキャリヤ１２の熱膨張を考慮してクリアランスを設けておいたキャリヤ１２の穴１２ｂを、キャリヤホルダー２２のピン２３に嵌めることで直接的にセットしてある。このようにキャリヤ１２の熱膨張による伸びを吸収する連繋手段５０を備えることで、簡単な構成でキャリヤ１２をキャリヤホルダー２２に対して回り止めをした状態に好適に連繋させることができる。これにより、キャリヤ１２の伸びを好適に逃がして吸収することができ、キャリヤ１２の変形を防止できる。また、キャリヤ１２は、キャリヤホルダー２２に嵌めることで装着する構成であるので、装着時における作業の簡素化がなされる。

【００２０】次に、キャリヤホルダー２２に備えられるキャリヤ１２の高さ調整機能について説明する。２３ａはフランジ部であり、ピン２３の中途部にワッシャー形状に一体に設けられている。このフランジ部２３ａは、キャリヤホルダー２２側に設けられ、キャリヤ１２を保持すべく直接的に支持する支持部になっている。ピン２３のフランジ部２３ａの下方には、ピン２３をキャリヤホルダー２２の下段部２２ｂに装着可能にネジ部２３ｂが設けられている。そのネジ部２３ｂキャリヤホルダー２２の下段部２２ｂに螺合する度合いを調整することで、フランジ部２３ａの高さ調整が可能に設けられている。このようにフランジ部２３ａを設けたことで、キャリヤ１２の高さ位置を好適に調整して、キャリヤホルダー２２でキャリヤ１２を適切に保持することができる。

【００２１】すなわち、フランジ部２３ａの高さを調整すれば、下定盤１６の研磨布１６ａが消耗して薄くなった場合等、条件の変化に好適に対応でき、その下定盤１６の研磨布１６ａ面とほぼ同じ高さで、キャリヤ１２が撓みを生じないように好適に保持できる。従って、キャリヤ１２を水平に好適に保持することができ、ウェーハ１０の研磨割れや、研磨精度劣化を防止することができる。また、フランジ部２３ａの表面によって、キャリヤ１２の外周面を部分的に受けることになり、キャリヤ１２の伸縮による摺動を好適に支持することができる。すなわち、キャリヤ１２の外周面（下面）とキャリヤホルダー２２側の上面との接地面積を小さくすることができるため、滑り摩擦抵抗を低減でき、キャリヤ１２は好適に摺動できる。これにより、キャリヤ１２の熱等による伸縮力が好適に開放され、キャリヤ１２の歪みの発生を防止できる。

【００２２】以上の実施例では、ピン２３のフランジ部２３ａの高さを調整することで、キャリヤ１２の支持高さを調整したが、本発明はこれに限られないのは勿論であり、キャリヤ１２を所定の高さに支持できる好適な手段であれば、その構成は特に限定されるものではない。例えば、キャリヤホルダー２２自体を昇降させる機構を設け、キャリヤ１２を保持すべく支持する支持部が基本的にキャリヤホルダー２２の下段部２２ｂの上面であってもよい。なお、下段部２２ｂの上面は、滑り性を向上させるため、凹凸を設けてもよいのは勿論である。

【００２３】次に図５に基づいて本発明にかかる他の連繋手段について説明する。図５（ａ）は平面図であり、図５（ｂ）は断面図である。本実施例は、図に明らかなように、前記実施例とは連繋手段５０のみが異なり、その連繋手段５０は、キャリヤホルダー２２側に設けられた内歯車状の被係合部５２と、その被係合部５２に遊びをもたせて係合するようにキャリヤ１２側に設けられた外歯車状の係合部４２とを具備する。すなわち、キャリヤ１２の外周に設けたギヤと、リング状のキャリヤホルダー２２の内周に設けたギヤとを遊びをもたせて噛み合わせた形態になっている。これによっても、簡単な構成でキャリヤ１２をキャリヤホルダー２２に好適に連繋させることができる。そして、前記実施例と同様の効果を得ることができる。

【００２４】次に、図１及び図２に基づいて、キャリヤ旋回運動機構２０の各構成にかかる実施例について説明する。２４はクランク部材であり、上定盤１４及び下定盤１６の軸線Ｌに軸心が平行であってキャリヤホルダー２２に軸着されるホルダー側の軸２４ａ、及びそのホルダー側の軸２４ａに軸心が平行であると共に所定の距離をおいて基体３０（図２参照）に軸着される基体側の軸２４ｂを備える。すなわち、クランク機構のクランクアームと同様な機能を備えるように形成されている。このクランク部材２４は、本実施例では基体３０とキャリヤホルダー２２との間の４ヶ所に配され、キャリヤホルダー２２を支持すると共に、基体側の軸２４ｂを中心にホルダー側の軸２４ａを旋回させることで、キャリヤホルダー２２を基体３０に対して自転しない円運動をさせる。ホルダー側の軸２４ａは、キャリヤホルダー２２の外周面に突起して設けられた軸受け部２２ｃに回転可能に挿入されて軸着されている。これにより、キャリヤ１

２は上定盤１４及び下定盤１６の軸線Ｌから偏心Ｍして旋回（自転しない円運動）する。その旋回円運動の半径は、ホルダー側の軸２４ａと基体側の軸２４ｂとの間隔（偏心Ｍの距離）と同じであり、キャリヤ１２の全ての点が同一の小円の軌跡を描く運動となる。

【００２５】また、２８はタイミングチェーンであり、各クランク部材２４の基体側の軸２４ｂに同軸に固定されたスプロケット２５（本実施例では４個）に掛け回されている。このタイミングチェーン２８と４個のスプロケット２５は、４個のクランク部材２４が同期して円運動するよう、４個の基体側の軸２４ｂ同士を連繋して同期させる同期手段を構成している。この同期手段は、簡単な構成であり、キャリヤ１２を好適且つ安定的に運動させることができる。これによって研磨精度を向上でき、ウェーハの平坦度を向上できる。なお、同期手段としては、本実施例に限られることはなく、タイミングベルト、またはギア等を用いてもよいのは勿論である。３２はモータ（例えば、ギャードモータ、又はサーボモータ）であり、３４は出力軸に固定された出力ギヤである。出力ギア３４はクランク部材２４の基体側の軸２４ｂに同軸に固定されたギア２６に噛合している。これにより、クランク部材２４を基体側の軸２４ｂを中心に回転させる回転駆動装置が構成されている。

【００２６】なお、回転駆動装置としては、各クランク部材２４にそれぞれ対応して配された複数のモータ（例えば、電動モータ）を利用することもできる。電動モータであれば、電気的に同期を取ることで、複数のクランク部材２４を同期運動させ、キャリヤ１２をスムースに運動させることができる。また、本実施例ではクランク部材２４を４個配設した場合について説明したが、本発明はこれに限らず、クランク部材２４は最低３個あれば、キャリヤホルダー２２を好適に支持することができる。さらに、直交する２軸の直線運動の合成によって２次元運動を得ることができるＸＹテーブルの移動体と、前記キャリヤホルダー２２とを一体化して運動できるようにすれば、１個のクランク部材２４の駆動によって、キャリヤホルダー２２を自転しない円運動させることができる。すなわち、ＸＹテーブルの直交する２軸に延びるガイドによって案内されることで、前記移動体は自転しない運動をするのであって、この移動体の運動をキャリヤホルダー２２の運動（自転しない円運動）に好適に利用できる。また、クランク部材２４を全く用いず、ＸＹテーブル自体に駆動手段を設けるようにしてもよい。すなわち、Ｘ軸及びＹ軸の部材をそれぞれ直接的に駆動させるサーボモータとボールネジ、又はサーボモータとタイミングチェーン等の組み合わせから成るＸ軸及びＹ軸の駆動機構を使用することで、前記移動体と一体化したキャリヤホルダー２２を運動（自転しない円運動）させてもよい。この場合は、最低２個のモータを使用することになるが、モータを制御することで旋回円運動の他にも自転しない種々の２次元運動を得ることができ、その運動をウェーハ１０の研磨に利用できる。

【００２７】３６は下定盤回転用モータであり、下定盤１６を自転させる動力装置である。例えば、ギャードモータ又はサーボモータを用いることができ、その出力軸は下定盤１６の回転軸に直結させてもよい。３８は上定盤回転用動力手段であり、上定盤１４を自転させる。下定盤回転用モータ３６と同様に電動モータ等回転動力となるものを適宜利用すればよい。下定盤回転用モータ３６及び上定盤回転用動力手段３８は、回転方向及び回転速度を自由に変更できるものとすれば、種々の研磨仕様に柔軟に対応できる。また、この両面研磨装置では、キャリヤ１２の透孔１２ａ内に配されたウェーハ１０を、図２に示すように上定盤１４と下定盤１６でサンドイッチにして、そのウェーハの研磨加工がなされる。この際、ウェーハ１０が挟圧される力は、主に上定盤１４側に設けられた加圧手段による（図１０参照）。例えば、空気圧を利用し、最大加圧力が上定盤１４の自重であり、空気圧を上昇させることで加圧力を低減させるように作用させるエアバック方式で上定盤１４のウェーハ１０への押圧力を調整するようにしてもよい。このエアバック方式では、空気圧を制御することで好適かつ容易に加圧力を調整できる。なお、上定盤１４側には加圧手段の他に上定盤１４を昇降動させる昇降装置４０が設けられ、ウェーハ１０の給排のときなどに作動する。

【００２８】また、図１に示すように、６２はローラであって、上定盤１４に当接し、その上定盤１４のキャリヤ１２の面に平行な方向への揺れを阻止する振動防止手段の一例である。このローラ６２は、適宜に上定盤１４の外周１４ｃに当接するよう、基体３０上の上定盤１４近傍に設けられたガイドローラ本体（図示せず）に回転自在に装着されている。この複数のローラ６２によって、研磨工程がなされる際に上定盤１４を挟むことで、上定盤１４のキャリヤ１２の面に平行な方向への移動を規制し、振動を防止できるのである。

【００２９】次に、液状の研磨剤の供給手段について、図１及び図３に基づいて説明する。上定盤１４には、その上定盤１４の研磨面１４ａとウェーハ１０が接触して該ウェーハ１０を研磨する研磨部へ、スラリー（液状の研磨剤）を供給する研磨剤供給用の孔１４ｂが設けられている。この研磨剤供給用の孔１４ｂは、ウェーハ１０の研磨部へ液状の研磨剤を十分且つ均一に供給でき、その研磨に悪影響を与えない大きさ等に適宜に設けられればよく、その形態或いはその数は特に限定されるものではない。なお、本実施例の研磨剤供給用の孔１４ｂは、上定盤１４に等密度に分布するよう、合計で２１個がマトリクス状に位置され、各々が小径に開けられて設けられている。なお、本実施例の研磨剤供給用の孔１４ｂは、上定盤１４に上下方向に貫通して設けられている。また、図３では示さないが、図１０のように研磨剤供給

用の孔１４ｂの上端にはチューブ等が連結されており、ポンプ等によって汲み上げられた液状の研磨剤が、適宜分配されて供給されるように設けられている。

【００３０】そして、キャリヤ１２には、研磨剤供給用の孔１４ｂより供給された液状の研磨剤を通過させて下の定盤（下定盤１６）の研磨面１６ａとウェーハ１０が接触して該ウェーハ１０を研磨する研磨部へ、液状の研磨液を供給する連通孔１５が設けられている。この連通孔１５は、キャリヤ１２の強度に影響を与えない位置に、適当な形態に設けられればよく、そのサイズ、形状或いはその数は限定されるものではない。なお、図３に示した実施例では、キャリヤ１２の中央と、キャリヤ１２の円周方向に隣合う透孔１２ａ同士間とに、合計で５個の円形の連通孔１５が開けられている。

【００３１】このキャリヤ１２によれば、液状の研磨液を、研磨されるウェーハ１０の両面に好適に供給することができ、好適に研磨することができる。すなわち、液状の研磨液が、キャリヤ１２に開けた孔である連通孔１５から流れ落ち、ウェーハ１０の裏面（研磨面１６ａと接触する面）にも好適に流れ込むことができる。このため、研磨条件を均一化でき、ウェーハ１０の両面を精度よく研磨できる。なお、研磨面１６ａ上に供給された液状の研磨液は、従来の両面研磨装置の場合と同様に、順次その研磨面１６ａから外周方向へ溢れ出て排出され、さらに回収されて適宜循環される。

【００３２】次に、図６～図９に基づいて、本発明の特徴的な構成である研磨剤供給手段の実施例について説明する。図６は下定盤に設けられた研磨剤供給手段を説明する断面図である。図７は上定盤に設けられた研磨剤供給手段を説明する断面図である。また、図８及び図９には、上定盤に設けられ、複数系統のスラリー（液状の研磨剤）の供給経路を備える研磨剤供給手段を説明する説明図である。なお、以上に説明した実施例と同一の構成については、同一の符号を付して説明を省略する。

【００３３】図６には、前記研磨面１２ａ、１４ａと前記ウェーハ１０が接触してそのウェーハ１０を研磨する研磨部へ液状の研磨剤（スラリー）を供給すべく、下定盤１６に設けた研磨剤供給用の孔１６ｂから、圧送されたスラリーを排出させる研磨剤供給手段を示してある。８５はスラリーを圧送する圧送供給装置であり、スラリーを貯留するタンク、及びスラリーを圧送するポンプ等から構成される。８６は連通路であり、下定盤１６を自転させる中空自転軸３６ａの軸心に上下方向に配されて研磨剤供給用の孔１６ｂに連通する上下管８６ａ、その上下管８６ａと圧送供給装置８５とを連通する水平管８６ｂ、及び管継手等によって構成されている。この連通路８６を介して、高圧に加圧されたスラリーが送られて研磨剤供給用の孔１６ｂから吐出される。この研磨剤供給手段によれば、十分な流量のスラリーを強制的に好適に前記研磨部へ供給（圧送）でき、特に研磨面１２ａ、１４ａを好適に冷却し、研磨面１２ａ、１４ａの表面温度を均一化できる。なお、下定盤１６の中心部に設けられた研磨剤供給用の孔１６ｂから吐出したスラリーは、下定盤１６の研磨面１６ａに受けられ、遠心力で中心部から外周へ好適に流れる。このため、研磨剤供給用の孔１６ｂは一つではあるが、スラリーを研磨部全体へ十分に多く好適に供給できる。

【００３４】図７には、前記研磨面１２ａ、１４ａと前記ウェーハ１０が接触してそのウェーハ１０を研磨する研磨部へ液状の研磨剤（スラリー）を供給すべく、上定盤１４に設けた研磨剤供給用の孔１４ｂから、圧送されたスラリーを排出させる研磨剤供給手段を示してある。８５ａはスラリーを圧送する圧送供給装置であり、スラリーを貯留するタンク、及びスラリーを圧送するポンプ等から構成される。８７は連通路であり、上定盤１４を自転させる中空自転軸３８ａの軸心に上下方向に配されて圧送供給装置８５ａに連通する上下管８７ａと、その上下管８７ａから分岐して研磨剤供給用の孔１４ｂに連通する分岐管８７ｂ、及び管継手等によって構成されている。この連通路８７を介して、高圧に加圧されたスラリーが送られて研磨剤供給用の孔１４ｂから吐出される。この研磨剤供給手段によれば、十分な流量のスラリーを強制的に好適に前記研磨部へ供給（圧送）でき、特に研磨面１２ａ、１４ａを好適に冷却し、研磨面１２ａ、１４ａの表面温度を均一化できる。なお、図６に示した研磨剤供給手段と、図７に示した研磨剤供給手段とを同時に利用してもよいのは勿論であり、研磨面１２ａ、１４ａの表面温度をさらに好適に均一化できる。

【００３５】次に、図６及び図７の実施例のように、スラリーを圧送することで、十分な流量のスラリーを研磨部へ供給することができる場合の作用効果について、比較実験に基づいて説明する。毎分０．５リットルのスラリーを研磨部に供給した場合と、毎分３．０リットルのスラリーを研磨部に供給した場合について、それぞれ、１回のウェーハの研磨工程を６０分とし、５回分の研磨工程（総計で３００分）を連続的に行った。なお、スラリーの流量以外の条件は同一とする。下定盤１６の表面（研磨面）の半径方向に異なる位置に８か所の測定ポイントを設定して、その各測定ポイントの表面温度について、研磨工程開始時（０分）を含めて６０分置きに測定した。そして、その各回の測定時における表面温度の平均値、及び各回の測定時毎における各測定ポイント間の表面温度のバラツキについて比較した。また、各研磨工程で加工された各ウェーハ毎に、そのウェーハの半径方向に異なる位置に８か所の測定ポイントを設定して、その各測定ポイントの厚さを測定してウェーハの厚さのバラツキについて比較した。

【００３６】以下に実験結果を説明する。先ず、下定盤１６の表面温度について説明する。毎分０．５リットルを供給した場合は、平均温度が、研磨開始時（０分）で

は摂氏約２２度であったものが、３００分を経過した時点では摂氏約３４度にまで上昇し、摂氏で約１２度のひらきが生じた。また、各回の測定時毎の各測定ポイント間の温度のバラツキは、最高が摂氏で約５度、平均では摂氏で約３度程度であった。これに対して、毎分３．０リットルを供給した場合は、平均温度が、全測定時を通して摂氏約２８度でほとんど一定（１度以内の差）であり、各回の測定時毎の各測定ポイント間の温度のバラツキは、最高が摂氏で約１．５度、平均では１度以下であった。

【００３７】次に、研磨加工されたウェーハの厚さのバラツキについて説明する。毎分０．５リットルを供給した場合は、最高で２．２μｍ、平均では１．３μｍのバラツキがあった。これに対して、毎分３．０リットルを供給した場合は、最高で０．８μｍ、平均では０．６μｍのバラツキであった。すなわち、毎分０．５リットルの場合と比較して倍以上の研磨精度を得ることができた。このように、毎分３．０リットルを供給した場合は、研磨面を均一温度に維持することができ、著しく精度の高いウェーハの平坦化を行うことができた。すなわち、スラリーの供給量を増やすことによって、各定盤１４、１６の研磨面１４ａ、１６ａの表面温度（研磨布面の温度）上昇を防止することができると共に、研磨面１４ａ、１６ａの表面温度のバラツキを小さくすることができる。このように研磨面１４ａ、１６ａの表面温度に関する研磨条件を均一に保つことによって、ウェーハの研磨精度を著しく向上できる。

【００３８】次に、図８及び図９に基づいて、複数系統のスラリーの供給経路を備える研磨剤供給手段について説明する。どちらの実施例も、研磨剤供給用の孔１４ｂが、上定盤１４の径方向について異なる複数の位置に設けられ、その複数の研磨剤供給用の孔１４ｂに対応し、スラリーを供給する経路が複数系統に設けられている。図８の実施例では、複数の圧送供給装置８８ａ、８８ｂ、８８ｃから、回転軸に設けられたディストリビュータ８９、及び回転軸内を通る管路等から構成される複数の供給経路９８ａ、９８ｂ、９８ｃを介して、スラリーを各研磨剤供給用の孔１４ｂから吐出させる。なお、ディストリビュータ８９は、回転する部材内に流体をシールして供給する公知の技術である。９７はシーケンサーであり、各研磨剤供給用の孔１４ｂの近傍に配設された温度センサー９９ａ、９９ｂ、９９ｃの信号を受けて、複数の圧送供給装置８８ａ、８８ｂ、８８ｃに指令信号を送る。これにより、各供給経路９８ａ、９８ｂ、９８ｃを流れて各研磨剤供給用の孔１４ｂから吐出されるスラリーの流量等についてフィードバック制御し、研磨面１４ａ、１６ａを冷却して、その表面温度を一定に維持する。

【００３９】すなわち、各圧送供給装置８８ａ、８８ｂ、８８ｃには、個々に、スラリーの温度を調整するタンクと、圧送するスラリーの流量を可変できるポンプ等が備えられている。従って、各圧送供給装置８８ａ、８８ｂ、８８ｃを、シーケンサー９７で制御することによって、研磨面１４ａ、１６ａの研磨熱が多く発生する部位近傍の研磨剤供給用の孔１４ｂへは、スラリーの供給量を高めるか、或いは低い温度のスラリーを供給できる。これによって、研磨面１４ａ、１６ａの各部位の加熱状況に対応して好適に冷却でき、その表面温度を全面的に均一化でき、ウェーハの研磨精度を著しく向上できる。

【００４０】また、図９の本実施例では、圧送供給装置８８ｄから分岐させ、複数の自動流量制御弁８３ａ、８３ｂ、８３ｃ、ディストリビュータ８９、及び回転軸内を通る管路等から構成される複数の供給経路９８ａ、９８ｂ、９８ｃを介して、スラリーを各研磨剤供給用の孔１４ｂから吐出させる。９７はシーケンサーであり、各研磨剤供給用の孔１４ｂの近傍に配設された温度センサー９９ａ、９９ｂ、９９ｃの信号を受けて、複数の自動流量制御弁８３ａ、８３ｂ、８３ｃに指令信号を送る。これにより、各供給経路９８ａ、９８ｂ、９８ｃを流れて各研磨剤供給用の孔１４ｂから吐出されるスラリーの流量を、複数の自動流量制御弁８３ａ、８３ｂ、８３ｃによって制御し、研磨面１４ａ、１６ａを冷却して、その表面温度を一定に維持する。

【００４１】このように、各自動流量制御弁８３ａ、８３ｂ、８３ｃを、シーケンサー９７で制御することによって、研磨面１４ａ、１６ａの研磨熱が多く発生する部位近傍の研磨剤供給用の孔１４ｂへは、スラリーの供給量を増やせば、研磨面１４ａ、１６ａの各部位の加熱状況に対応して好適に冷却でき、その表面温度を全面的に均一化できる。従って、ウェーハの研磨精度を著しく向上できる。なお、シーケンサー９７と、温度センサー、及び圧送供給装置又は自動流量制御弁との信号のやり取りは、本実施例のように配線で行ってもよいし、無線によって行うことができるのは勿論である。また、スラリーを圧送する圧力は、２～３ｋｇ／ｃｍ² 程度でよいが、さらに高圧にしても良い。また、以上の実施例では、上定盤１４に複数系統のスラリーの供給経路を設けた場合を説明したが、本発明はこれに限らず、下定盤１６に設けることも可能である。

【００４２】次に、本発明にかかる両面研磨装置の使用方法の一例について説明する。先ず、キャリヤ１２を運動させないで、上定盤１４と下定盤１６とを回転速度の絶対値は同じであるが反対方向へ回転させた場合を説明する。すなわち、図１に示すように、例えば、上定盤１４は時計回転をさせ、下定盤１６は反時計回転させる。この場合は、全く反対方向に摩擦力が作用するから、その運動力が相互に相殺されて、理論的にはウェーハ１０は止まった状態で両面の研磨がなされる。但し、この場合には、上定盤１４及び下定盤１６では、その外周へ向

かう程その周速度が大きくなる。従って、ウェーハ１０の上定盤１４及び下定盤１６の軸線Ｌに対応する部分から遠い部分ほど研磨が促進され、ウェーハ１０が均一に研磨されない。

【００４３】次に、キャリヤ１２を前述した構成からなる運動機構によって、自転しない円運動をさせることによる研磨作用について説明する。上定盤１４及び下定盤１６の回転を考えず、キャリヤ１２の自転しない円運動のみを考えた場合、その自転しない円運動によれば、運動をする部材（キャリヤ１２）の全ての点で全く同じ運動がなされることになる。これは、全ての点が同一の運動となる意味で、一種の揺動運動であり、揺動運動の軌跡が円になったと考えればよい。従って、自転しない円運動をするキャリヤ１２を介し、ウェーハ１０を旋回移動すれば、この運動による作用に限っていえば、ウェーハ１０の両面は均一に研磨される。

【００４４】そして、上定盤１４と下定盤１６の回転運動と、キャリヤ１２の自転しない円運動とを同時に作動させた場合は、ウェーハ１０が透孔１２ａの中で回転可能に保持されているため、特に上定盤１４と下定盤１６の回転速度の絶対値に差をつけた場合（一方の定盤に対して他方の定盤の回転速度を速くした場合）、ウェーハ１０は、その回転速度の速い側の定盤の回転方向へ、連れ回りする。すなわち、ウェーハ１０は所定の方向へ自転することになる。このようにウェーハ１０が自転することで、上定盤１４及び下定盤１６では、その外周へ向かう程その周速度が大きくなっているが、その影響をなくすことができ、ウェーハ１０を均一に研磨できる。なお、ウェーハ１０の両面を均一に研磨するには、上定盤１４と下定盤１６の回転速度を交互に一方が速くなるように制御すればよい。

【００４５】次に、本発明にかかる両面研磨装置の使用方法の他の例について説明する。以上の実施例では、複数の透孔１２ａが設けられ、複数のワーク（ウェーハ１０）を同時に研磨する場合について説明したが、本発明ではこれに限らず、例えば、キャリヤ１２には大型なワークが保持される透孔１２ａを一個のみ設け、その大型ワークの両面を研磨する研磨装置としても利用できる。なお、大型なワークとしては、液晶に用いる矩形状のガラス板、或いは枚葉で加工されるウェーハ（円形）等のワークがある。この場合、大型なワークは、キャリヤ１２の中心からその周縁近傍付近にわたってほぼ全面的に配されることになる。このとき、キャリヤ１２による自転しない円運動を主に利用して研磨し、上定盤１４及び下定盤１６の回転速度は、研磨むらが発生しない程度に遅くすれば、ワークの全体面について均一に且つ好適に研磨できる。すなわち、上定盤１４及び下定盤１６では、周速度の違いで外周ほど研磨作用が大きくなるが、その回転速度がキャリヤ１２の自転しない円運動に比べて非常に遅ければ、研磨作用に直接的には殆ど関与させないようにすることができる。そして、上定盤１４及び下定盤１６を回転させることは、ワークに接触する定盤面を常に更新させ、液状の研磨剤をワークの全面へ平均的に供給するなど、研磨作用を良好にするため、間接的に好適に寄与できる。

【００４６】以上の実施例ではポリシング装置について説明したが、本発明はラッピング装置にも好適に適用できるのは勿論である。以上、本発明につき好適な実施例を挙げて種々説明してきたが、本発明はこの実施例に限定されるものではなく、発明の精神を逸脱しない範囲内で多くの改変を施し得るのは勿論のことである。

【００４７】

【発明の効果】本発明の両面研磨装置によれば、研磨剤供給手段によって、上定盤及び下定盤の研磨面とワークが接触して該ワークを研磨する研磨部へ液状の研磨剤を供給すべく、上定盤及び／又は下定盤に設けた研磨剤供給用の孔から、圧送された液状の研磨剤を排出させる。これによれば、自転しない円運動をするキャリヤを備える両面研磨装置にあって、前記研磨部へ十分な流量の液状の研磨剤を供給することが可能となり、前記研磨面の表面温度を均一に維持することができるため、研磨精度を向上させることができるという著効を奏する。

【図面の簡単な説明】

【図１】本発明にかかる両面研磨装置の一実施例の斜視分解図である。

【図２】図１の実施例の側断面図である。

【図３】図１の実施例のキャリヤとキャリヤホルダーの全体を示す平面図と断面図である。

【図４】本発明にかかる連繋手段の要部を説明する断面図である。

【図５】本発明にかかる連繋手段の他の実施例を示す平面図と断面図である。

【図６】本発明にかかる研磨剤供給手段の一実施例を説明する断面図である。

【図７】本発明にかかる研磨剤供給手段の他の実施例を説明する断面図である。

【図８】複数経路を備える研磨剤供給手段の一実施例を説明する説明図である。

【図９】複数経路を備える研磨剤供給手段の他の実施例を説明する説明図である。

【図１０】背景技術の研磨剤供給手段を説明する断面図である。

【図１１】従来技術を説明する断面図である。

【図１２】従来技術のキャリヤの配置を説明する平面図である。

【符号の説明】

１０　ウェーハ
１２　キャリヤ
１２ａ　透孔
１２ｂ　穴

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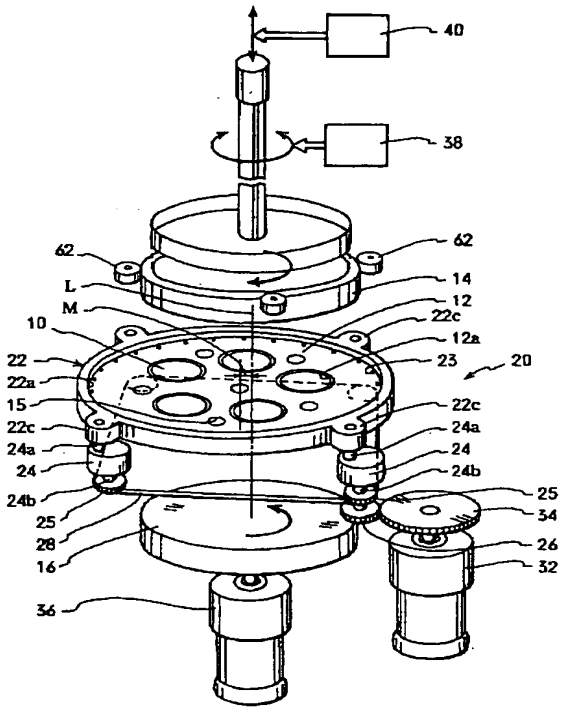
１４　上定盤
１４ａ　研磨面
１４ｂ　研磨剤供給用の孔
１５　連通孔
１６　下定盤
１６ａ　研磨面
２０　キャリヤ旋回運動機構
２２　キャリヤホルダー
２３　ピン
２４　クランク部材
２４ａ　ホルダー側の軸
２４ｂ　基体側の軸
２８　タイミングチェーン

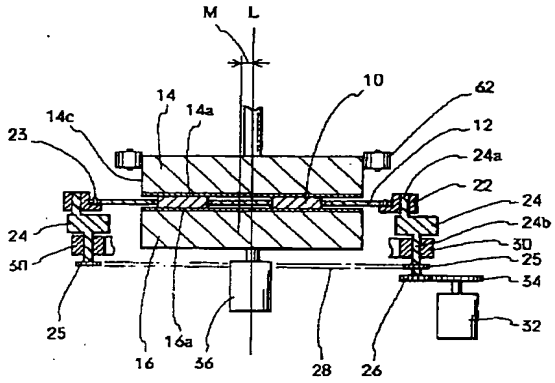
18

＊３０　基体
３２　モータ
４０　上定盤の昇降装置
８５　圧送供給手段
８５ａ　圧送供給手段
８６　連通路
８７　連通路
８８ａ、８８ｂ、８８ｃ　圧送供給手段
８８ｄ　圧送供給手段
８９　ディストリビュータ
９７　シーケンサー
９８ａ、９８ｂ、９８ｃ　供給経路
＊　９９ａ、９９ｂ、９９ｃ　温度センサー

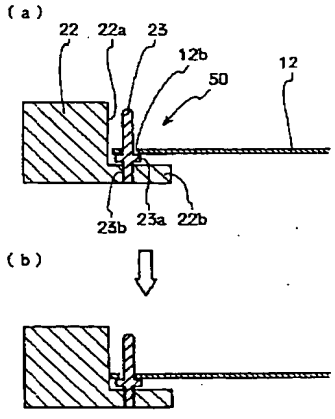
【図１】



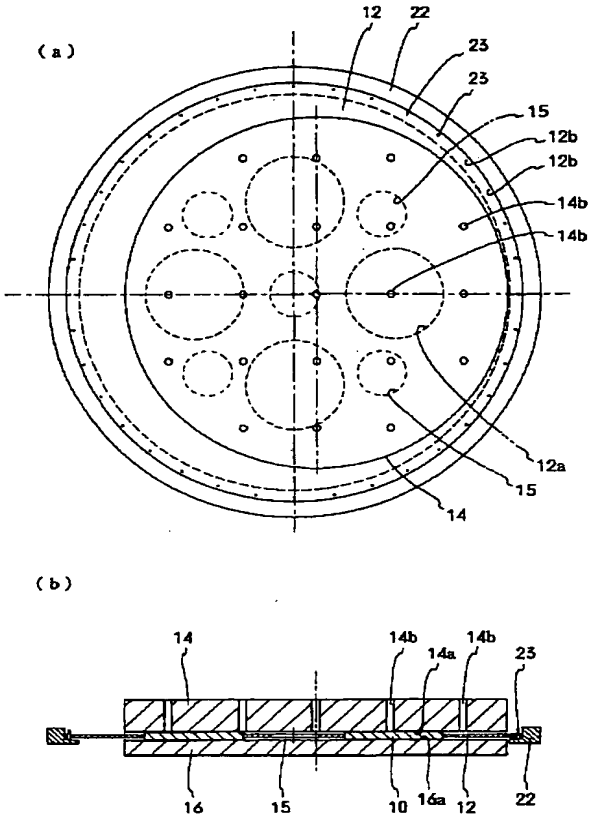
【図２】



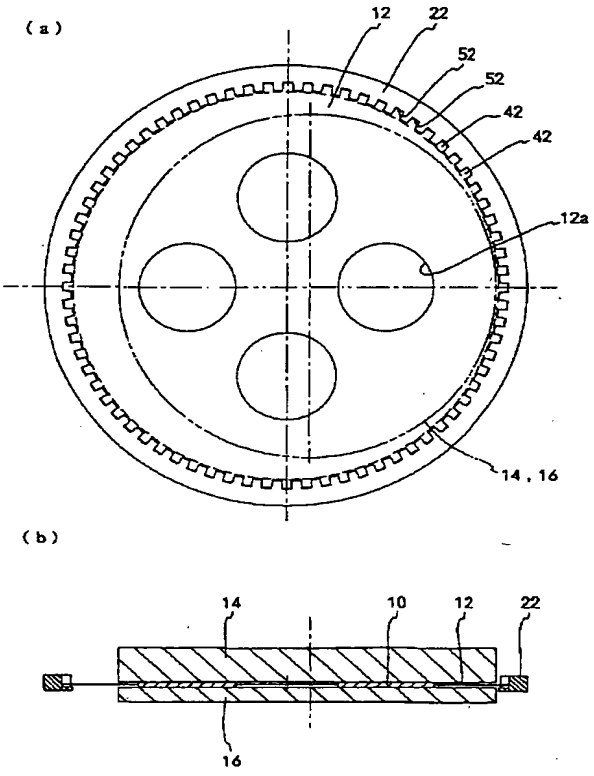
【図４】



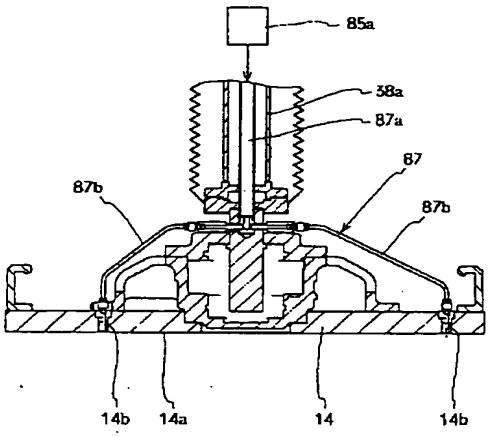
【図３】


(a)
12
22
23
23
15
12b
12b
14b
14b
12a
15
14
(b)
14
14b
14a
14b
23
16
15
10
16a
12
22

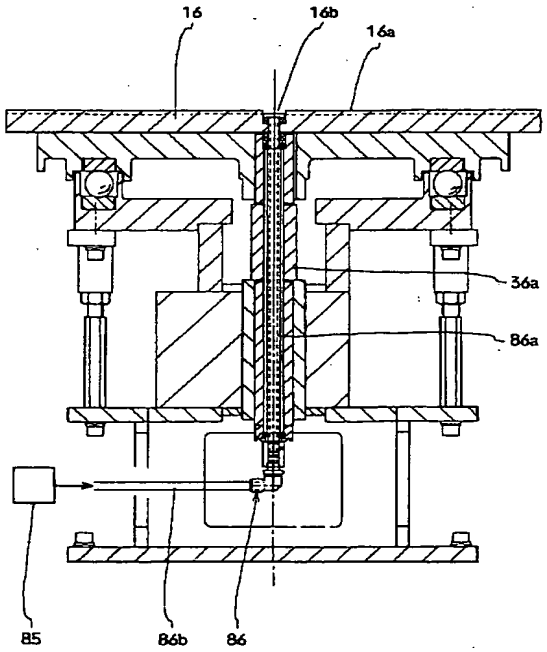
【図５】


(a)
12
22
52
52
42
42
12a
14，16
(b)
14
10
12
22
16

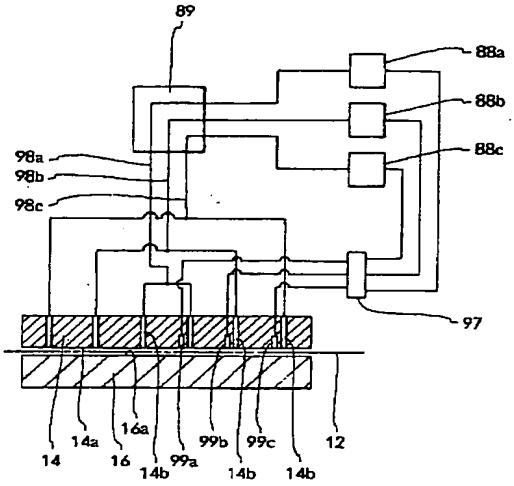
【図７】


85a
38a
87a
87
87b
87b
14b
14a
14
14b

【図６】


16
16b
16a
36a
86a
85
86b
86

【図８】


89
88a
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88c
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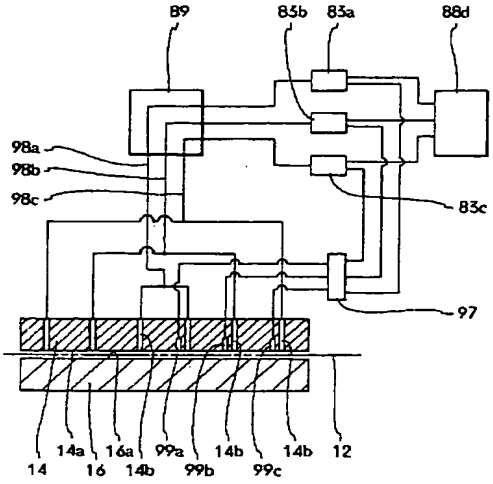
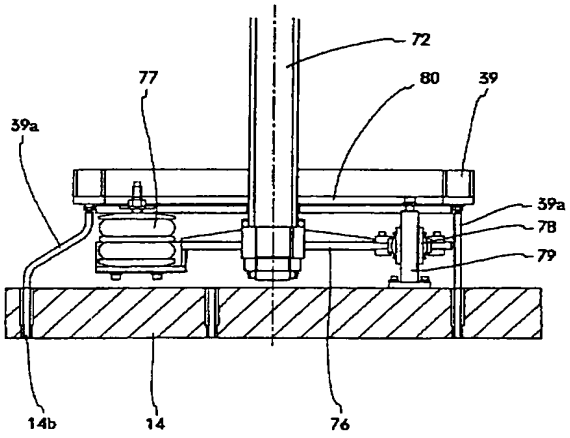
98c
97
14
14a
16
16a
14b
99a
99b
14b
99c
14b
12

【図９】


89
85b
83a
88d
98a
98b
98c
83c
97
14
14a
16
16a
14b
99a
99b
14b
99c
14b
12

【図１０】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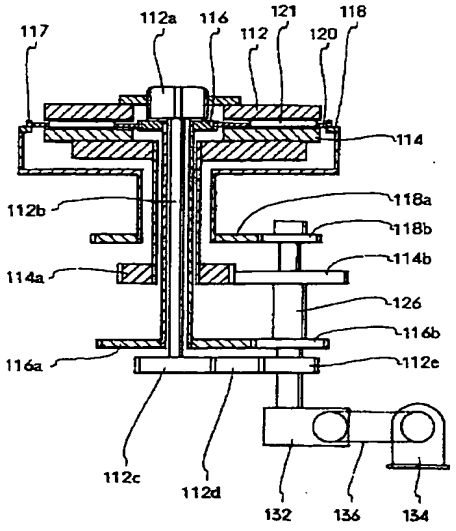
77
80
39
39a
39a
78
79
14b
14
76

【図１１】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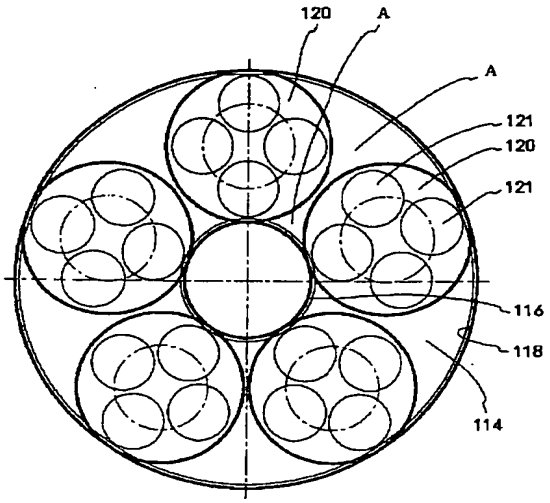
114b
114a
126
116b
116a
112e
112c
112d
132
136
134

［図１２］



フロントページの続き

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Ｆターム(参考)　3C058 AA07 AA16 AB04 AB06 AC04 CB01 DA06 DA18